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Using Cost Figures to Cut Costs

Cost Figures Show How to Eliminate Unnecessary Supervision—Rearrangement of Work Cut Labor Cost and Increased Weekly Wages

By WILLIAM R. BASSET
Miller, Franklin, Basset & Co.

MANUFACTURERS not infrequently say, as an argument against cost accounting, "What is the use of knowing my costs? I can't use them as a basis for setting my selling prices; competition tells me what my selling price shall be."

Probably it is to have a guide in determining a profitable selling price that leads most men to install cost finding methods. Actually there is much to the argument that the selling price is determined more by competition than by cost figures. But the biggest value of a cost system is, I feel, to show that extravagances or inefficiencies exist, before they run into heavy losses, and to indicate how the cost of a product may be cut. In short, cost figures properly developed are a guide to correct manufacturing, selling and financing. They make the policies of the business.

Listing Overhead

A part of every modern cost system is a sheet for each department of the shop on which each item of overhead expense is listed. The normal amount of each item for normal operation of the department is listed and against it is the actual amount for the month. At the bottom of the sheet are shown the normal productive hours as against the actual.

In one shop, this sheet showed that productive department X operated only 3,000 hours as against 8,000 normal. But the charge for the foreman's salary remained constant. This suggested, as the entire shop was operating subnormally that perhaps the foreman of department X could be dropped or put on other work and that temporarily the foreman of department Y could handle both departments. This was done.

The expense analysis showed that department X ordinarily used four truckers, which when work fell off had been reduced to three. But it also showed that there was only about 40 per cent of the normal amount of product to be moved, so one more trucker was dropped. A stock chaser seemed to be needed and as he was a good man, he was kept, but he was given in addition to his regular duties those of another factory clerk who was let out.

In this shop, the force had been cut by guess as soon as production dropped, but the first of the month the expense analysis showed the manager how to lop off $3,500 a month more of the expense. He had actual figures to guide him as to overhead expense.

He also had actual figures on which to base the reduction of productive workers, for his labor reports showed him beyond doubt which of his workmen were efficient and should be kept, and which were mediocre and should be dropped. He did not have to rely on the opinion of a foreman who might be inclined to keep a worthless brother-in-law on the payroll.

So much for the use of a cost system when business slumps. It can be made to show the possibilities of savings when operation is normal.

In another shop, the monthly statement of operations which is drawn up as part of the cost finding showed that the reduced selling prices which were forced upon the company had turned profits into losses. The first thought was to overcome the loss by reducing wages but this seemed inadvisable because of a touchy labor situation. In fact because the men's wages had not kept up with the increases for similar work in other concerns it seemed necessary to enable the men to earn more.

Further scrutiny of the detailed cost figures showed that the losses were due to four causes.

First, much time was lost due to machine operators waiting for work, the entire shop at times being held up, especially in the morning, waiting for the moving gang to bring in work for them.

Second, there was a great deal of non-productive time due to frequent changes of set-up for various sizes, with the possibility that half the machines would change from 6-in. to 8-in. and back to 6-in. again in the same day, and the night gang changed to 8-in. again in the middle of the shift.

Third, frequently the foreman of the night gang would have to shut down half his machines and take the men out into the yard to bring in stock to keep them busy, for there was no moving gang on at night.

Fourth, the greater part of the foreman's time was taken up trying to keep his machines busy, so that he had little or no time to give to inspection, supervision and education.

The first three of these faults were plainly shown by the cost reports—borne out by personal observation. Investigation showed the possibilities of both reducing costs and increasing somewhat the earnings of the men.

The machine shop in this concern was the "neck of the bottle" from a production and shipping point of view. This department was considerably behind the foundry although it was running a day gang of 50 men and a night gang of 25 men.

There was no attempt at planning. The foreman gave verbal orders to the moving gang boss to bring in semi-finished stock as the occasion required, or the moving gang boss would send in stock as it suited his convenience.

Labor was indifferent and inefficient, took no interest in the work, was content to sit and wait for work to be brought to the machines, worked at a slow rate and

stalling was prevalent. The men were paid on a daily wage scale which varied according to length of service and the bargaining ability of the individual. They had no incentive to make them do more or better work.

The problem was to make it possible for the men to earn more money and to get a production increase which would not only offset the higher wages but decrease costs as well.

The first step was to set up planning machinery, put in a production and time-keeping booth and put into use the following forms: (1) Weekly requisition of parts to be machined—from production and shipping office; (2) daily work schedule—made out by booth man and foreman from weekly requisition; (3) moving gang move order—made out twice daily; (4) individual job ticket; (5) weighman's report of stock finished: (6) daily inventory of goods in process at end of shift.

These forms gave control of stock and insured a supply of parts at all times.

Meanwhile, time studies were taken on the various operations and, when the planning machinery was running smoothly, piece rates were put on all productive operations. In order to enlist the interest and co-operation of the non-productive workers, it was agreed to pay them as a bonus, the general average increase in pay above the base day rate earned by the men on piece rates. This included the foreman, booth men, crane operator, crane helper, weighman, repairman, toolroom men and general cleaner. In this way, every man in the department was interested in getting out more production, for each received his share in the increase.

The results which have been obtained are shown by the following figures. The "before" figures are monthly averages for four months in 1920; the "after" figures are monthly averages for five months in 1921 after the new methods were in operation.

	Before	After	Improvement per Cent
Total production in units	278.86	473.67	69.7
Cost per unit	$11.08	$8.30	25.1
Average wage	$4.37	$6.12	32.0

These figures are taken from the regular cost records of the concern. They are not hopes or guesses.

While the increased production and decreased costs undoubtedly made the biggest appeal to the owners; yet they say that there are other although perhaps less tangible results that are of nearly equal value. These are:

(1) Production control by the production department which knows every day just where the shop stands on orders to be machined, and is therefore able to meet promises of shipments on time.

(2) Superior quality of workmanship and better inspection which comes from relieving the foreman of stock chasing and so gives him an opportunity to inspect and supervise the work.

(3) Increase in shop efficiency, morale, care of machines, pride in work, and general shop cleanliness and orderly appearance.

These results came in a shop that was as well managed as the average even before the betterments were made.

Here is a case taken from the brass spinning department of a machine shop:

Spinning is performed on a light, high-speed lathe. In this operation, the workman has to bear heavily with a tool against the rapidly revolving work on the lathe.

The bearings of these spinning lathes wear rapidly and when worn the lathes vibrate badly. This vibration is transmitted to the workman and is so unpleasant that most workmen will lay off rather than suffer it.

In one plant the cost reports showed that on an average four out of twelve spinning lathes were out of service all of the time for this reason, although it takes but a few hours to replace the bearings. Frequently they were down five or six weeks because no extra bearings were kept in stock.

To an obvious suggestion that a dozen sets of bearings be carried in stock, the management objected that this would tie up several hundred dollars. They denied that the investment would be worth while.

As the spinning operation was the "neck of the bottle," there was no difficulty in proving that the production of the entire plant was reduced by approximately $10,000 a month on a product for which there was a ready sale at all times. Of this amount, about $5,000 a month was profit and overhead expense, which was a net loss to the concern. When these figures were realized by the management, extra bearings were put in stock with the result that now the lathes are never down more than a few hours.

This condition, and the loss it was causing were shown by the cost reports which were excellently designed to give not only cost figures but an index of the manufacturing efficiency. The trouble was that the management had not been making full use of its cost system.

The expense analysis in another plant indicated that for the work done the expense of the maintenance department was too high. This concern had its maintenance force divided into five gangs of carpenters, electricians, steam-fitters, concrete men and machine repair men. Each gang had a foreman who was paid from $200 to $250 a month.

It was possible to bring all gangs closely under the supervision of a master mechanic and do away with the foreman, by appointing one good workman in each gang to be gang leader. The gang leaders were paid $125 a month. The saving on foremen's salaries paid the salary of the master mechanic and left a net saving of $3,600 a year. The maintenance work is done as well and as promptly as before.

In another plant the cost records showed that there was an excessive maintenance cost and at the time, entirely too much idle machine time due to breakdowns. An investigation showed that no attention was given to machines, belting, shafting or motors until a breakdown actually occurred. Then several maintenance men would make a grand rush to the spot. It was necessary to keep on the payroll enough men to handle these emergencies when they arose; but these men were idle a good part of the time.

The obvious remedy was to eliminate the emergencies as far as possible. This was done by making the maintenance gang act as inspectors who now patrol the plant according to schedule, examining all machines and equipment for signs of wear. When they find a place where it appears that repairs are soon to be needed they make them before serious trouble appears. This gives the foremen a chance to schedule work ahead to other machines and so reduce the loss of production. But by preventing emergency breakdowns it allows all of the maintenance and repair work to be done with just one-half as many maintenance men. In this plant, that alone is a saving of $9,200 a year.

Careful study of cost figures may result in sweeping changes not only in policies but in methods of wage

payment, layout of the shop and methods of working. This is exemplified by the experience of the management of a shop which operated its own foundry. Their cost figures had suggested the possibility of increasing production without adding to the force. That of course would mean reduced costs.

This shop turned out thin-sectioned, cored iron castings. It was a repetitive, quantity production shop. The castings were standard; there was no job work.

In the effort to increase production, time studies were taken and piece rates set which were based on fair standards of production. The men, however, not only refused to accept the piece rates; they refused to go beyond the daily tasks to which they were accustomed. The owners could not accept this refusal. It was necessary to devise means which would so alter the conditions of work that they would be without traditions of wage incentive on output. This was the problem.

Under the old method of working, a molding team consisting of a molder and helper, "put up" a stated number of molds, after which they poured off the molds themselves. Another set of men appeared at the end of the molders" period of duty and while two of them "cut" the sand, the remainder "shook out" the castings from the molds and removed the castings to the cleaning room.

Under the new method, the molders mold all day and do nothing else. A special team, equipped with a large ladle on an overhead track, does the pouring, which goes on concurrently with the molding, the molds being conveyed from the molding room to the pouring room by storage battery trucks. As fast as the molds are poured, they are taken on the trucks to a shakeout pit where they are lifted in groups of twelve by an electric hoist and the sand removed from the castings. As soon as the shakeout is completed, the castings are wheeled to the cleaning room.

Meanwhile the sand, which has been dumped into the shakeout pit, is removed by an elevator and passed through a sand treating machine and a cooling elevator into one-yard dump cars. These cars run on a narrow gage track above the molding sand hoppers, and the treated sand is dumped into the top of the hoppers. Each molder works below a sand hopper. The molders are thus kept constantly supplied with treated sand, this arrangement removing all limit to their output, aside from their own natural limits of physical capacity. Physical limits of the molders' capacity are extended by so disposing the hoppers and the trucks which receive the molds as to minimize the lifting which a molder is required to do.

In commenting upon the results which are stated below, it must be pointed out that the improvement shown was accomplished in spite of the excellent work which was done by the molders under the old system. There were no more industrious or efficient workers in the plant than the old molders. That this is true is proved by the unfailing evidence of time studies, which disclose the uniformity of individual performance times that connotes good work.

Here are the results from the changes:

	Per Cent
Average monthly production increase per molding team	62.9
Month's average production increase best molding team	78.1
Maximum individual team increase (one day only)	106.0
Monthly average wage increase—molders	26.7
Monthly average wage increase—all employees	16.7
Average labor and expense cost reduction	18.5

These are actual figures, but they are taken at a time when, due to lack of orders, the foundry is running much below capacity.

Based on the cost analyses, it appears certain that at normal activity of the plant, the cost per unit will be reduced a trifle more than 32 per cent due to the increased production per man.

Looked at another way, the reduction already actually accomplished enables the foundry to turn out its old daily production at a saving of $127.24 per day or a little more than $38,000 a year. That is considerably more in one year than the total cost of making the changes.

It should be clear from these instances that properly designed cost figures can be made to show unerringly where betterments are possible. Without them, it is necessary to study every process and operation in the plant indiscriminately—an ineffective and time consuming way.

The cost system should not be a thing apart from the general accounting of the business. Formerly business men found from the statement of condition—or balance sheet—and the statement of operations, how they stood at the end of the year. They tried—usually without success—to find out *why* they had made or lost money. But these financial statements show the business as a lump. The figures must be divided to show the various activities of the business, and the reports must analyze operations and conditions to show what actually goes on. When the general accounting is refined so that this is done, we have a cost system.

Keeping the Customer Satisfied

A well known lathe manufacturer who takes pride in the accuracy and reliability of his product, received a letter from a customer some hundreds of miles away, to the effect that a recently shipped lathe was not performing in a satisfactory manner. The customer stated that when a bar was placed on centers, turned for half its length, its position reversed and the remaining length turned, the two cuts would not be concentric in relation to each other; this proved the spindle to be not round, or out of alignment, or something. The closing paragraph of the letter informed the manufacturer that the defective lathe was being prepared for re-shipment to the factory.

The manufacturer immediately wired the cutsomer as follows: "Do not ship lathe. Am leaving for X tonight."

Arriving at the customer's factory after a tedious journey, he asked to see the lathe. A single glance was sufficient to reveal the "pug-nose" on the center, the result of having been driven to place with a hammer or other convenient weapon in the hands of the overzealous workman who set up the lathe in the customer's shop.

The center was not hardened. The manufacturer started up the lathe and, with a suitable tool, had the center redressed smooth and true in a very few seconds. The same test of bar turning as before now being applied, the two cuts were found to meet so exactly that the meeting point could be determined only by close observation.

The manufacturer was not in the plant half an hour; had not, in fact, even removed his overcoat. He lost two or three valuable days on the round trip and traveled nearly a thousand miles—to dress a lathe center, for the damage to which he was in no way responsible; but he left a satisfied and somewhat apologetic customer.

Supplying Oil to 2,000 Automatic Screw Machines

Oil Pumped from Tank Cars to Storage Tanks—Centrifugal Machines Separate Used Oil from Chips—An Elaborate System of Reclamation and Distribution

By E. C. HENN

IN THE Coit Plant of The National Acme Company at Cleveland, Ohio, where more than 2,000 multiple-spindle automatic screw machines and secondary operation machines are housed under one roof and over a floor space of more than ten acres, the supply of cut-

FIG. 1. SOME OF THE OIL SEPARATORS

ting lubricant is of vital importance. Storage, distribution and reclamation are three significant factors of the problem, the immensity of which is readily appreciated considering the great variety of materials cut and the volume of different lubricants used each working day.

Operating at normal capacity, this plant turns out over a million and a half parts a day. Almost all of this work has its first operation performed in the automatic screw machine department. Not infrequently, the parts are completed upon the automatics. However, when conditions prohibit completion on the automatics, they are finished in the auxiliary or secondary screw machine department.

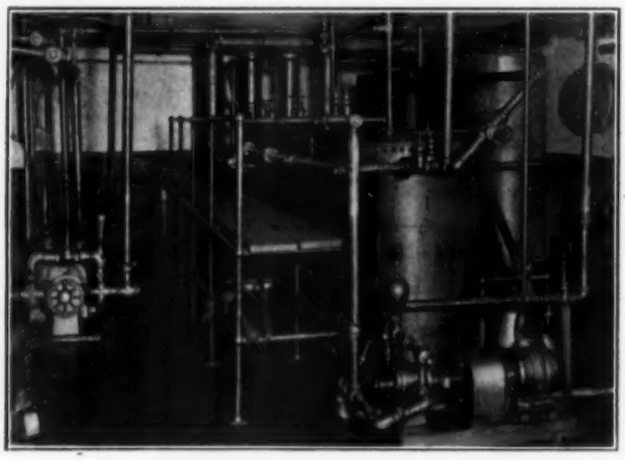


FIG. 4. THE RECLAMATION PLANT

Production in the automatic screw machine department is not interrupted during the working day by the gathering of work from the machines. When the operators leave their machines at the end of the shift, a night crew collects the parts and turnings from the automatics and takes the material in metal pails to the cleaning department where the first step in the reclamation process is conducted.

In this department, the pails are emptied into centrifugal oil separators where practically all of the oil adhering to the turnings and finished product is reclaimed and piped into the central storage and reclaiming plant. There are ten of these centrifugal separators, some of which can be seen in Fig. 1. One or more, as the quantity of production may require, are devoted to the reclamation of a certain type of lubricant. For example, four separators may be operating for the reclamation of lubricant from brass parts and turnings, five devoted to certain type steel parts and turnings and

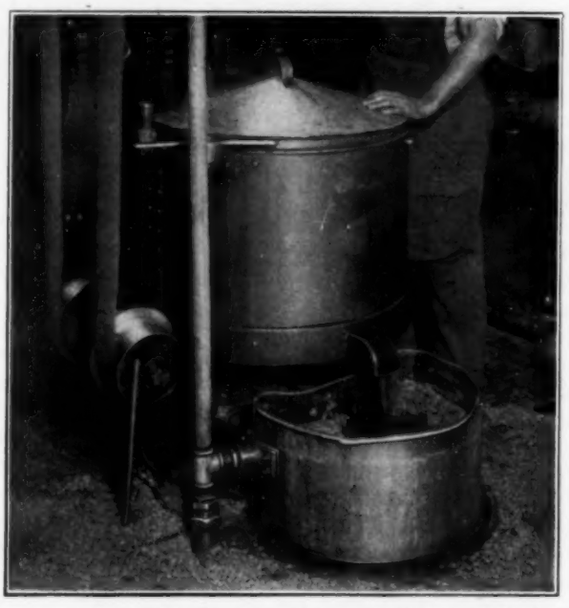


FIG. 2. CLOSE-UP VIEW OF ONE OF THE SEPARATORS

the remainder reclaiming a lubricant used in the cutting of another type of steel. A close-up view of one of the separators is shown in Fig. 2.

The storage and reclaiming plant is built under the ground floor of the building and is centrally located. In this plant are found the large storage tanks in which new oil from the tank cars is received; the large service tanks from which oil is dispensed to the distributing stations, and a very complete system of settling and sterilization tanks for the reclamation of the used lubricants.

Taking the two most important lubricants, i.e., those used in cutting of steel and brass, we will follow them through the various processes of reclamation. The

steel cutting oil is piped from the centrifugal separators *B*, Fig. 3, to the underground reclamation plant. Here it passes through a series of three primary settling tanks each having a capacity of approximately 25 gal. These tanks are about 10 in. in diameter and 6 ft. high. They are installed in parallel alignment with each other and are shown at *J*. The oil is piped into the first tank near its top. It flows out of the first tank through a pipe connected also at the top and enters the second tank near its base. This arrangement of piping which facilitates the progress of the clean oil and the settling of the sludge and undesirable residue, is continued on through the third primary tank. The sludge is cleaned from the bottom of these primary tanks at the end of each working day.

In the first of the primary tanks, the lubricant is treated with heat by a steam coil to raise the gravity of the fluid and accordingly enable the undesirable substances to settle more readily through the oil to the bottom of the tanks, and also to insure the flow of the cleaner and lighter oil from the top of the tanks.

In the next stage of reclamation, there are two secondary settling tanks, Fig. 4, each having a capacity of 400 gal. The used oil from the last primary tanks flows through both of the secondary tanks continuously and undergoes a settling process.

From the secondary tanks, the lubricant flows into the two 400-gal. sterilization tanks *T*, Fig. 3, where its temperature is raised from between 210 to 220 deg. F. for the sterilization process and the removal of objectionable bacterium growths. From the sterilization tank the oil flows by gravity to the service tanks *D* or *E* which are buried under the ground floor and adjacent to the central station, and from the service tanks the lubricant is pumped to the outlying disbursing stations.

At intervals of two or three days, depending upon operating conditions, one of these secondary settling and sterilization tanks is shut down for cleaning. Its contents, an accumulation of heavy oil and residue, is

CHEMICAL LABORATORY REPORT NAMCO

Lab. No. 1545

Analysis of 3 to 1 Cutting Oil Date 5/18/21

From [redacted] Car No. U.T.L.X. 22154

Lard Oil Content 26.10% Good

Temperature of oil in car = 82° F.

Capacity of tank car = 8000 gal.

Remarks: Oil level in car 5" below bottom of dome.

FIG. 5 Chemist JVGO

CHEMICAL LABORATORY REPORT NAMCO

Lab. No. 1242

Analysis of No.1 Lard Oil - Inedible Date 6/14/20

From [redacted] Car No. DL&W 6612

Saponifiable Oil 100%

Shows absence of any mineral oil.

Iodine Absorption value 61.2
Shows No.1 Quality

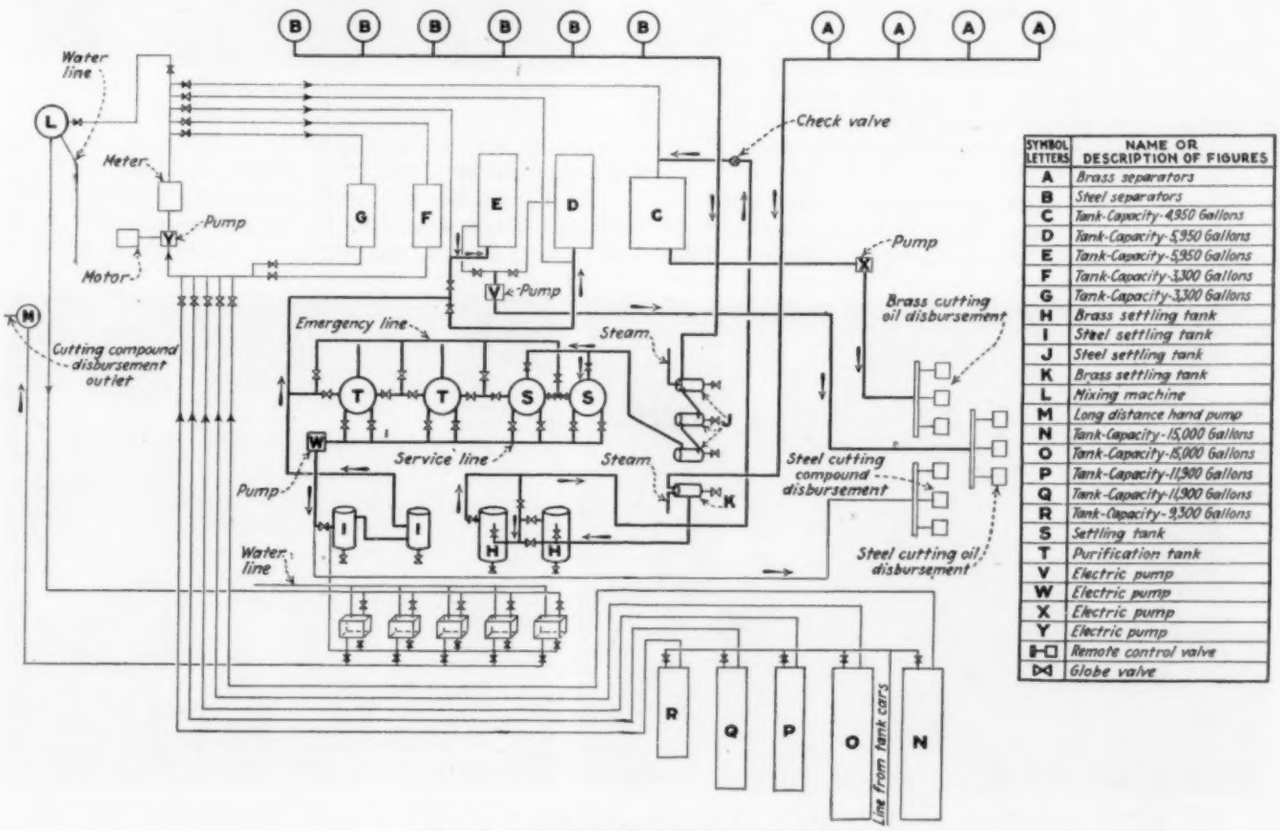
Free fatty acid as Oleic acid = 20.46%

Remarks:

100 bbls. in lot.

FIG. 6 Chemist JVGO

FIGS. 5 AND 6. LABORATORY REPORTS ON OIL RECEIVED



SYMBOL LETTERS	NAME OR DESCRIPTION OF FIGURES
A	Brass separators
B	Steel separators
C	Tank-Capacity-4,950 Gallons
D	Tank-Capacity-5,950 Gallons
E	Tank-Capacity-5,950 Gallons
F	Tank-Capacity-3,300 Gallons
G	Tank-Capacity-3,300 Gallons
H	Brass settling tank
I	Steel settling tank
J	Steel settling tank
K	Brass settling tank
L	Mixing machine
M	Long distance hand pump
N	Tank-Capacity-15,000 Gallons
O	Tank-Capacity-15,000 Gallons
P	Tank-Capacity-11,900 Gallons
Q	Tank-Capacity-11,900 Gallons
R	Tank-Capacity-9,300 Gallons
S	Settling tank
T	Purification tank
V	Electric pump
W	Electric pump
X	Electric pump
Y	Electric pump
	Remote control valve
	Globe valve

FIG. 3. LAYOUT OF THE OIL SYSTEM

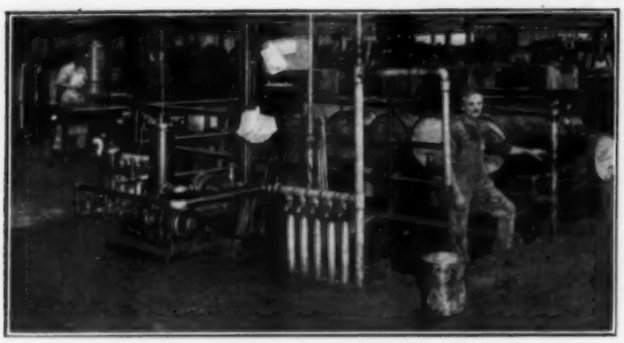


FIG. 7. THE CENTRAL PUMPING STATION

pumped into a series of two 250-gal. secondary tanks *I*. Here it is allowed to settle for a period of 24 hr. Upon completion of the settling process the clean oil is pumped into the service tanks *E* and *D*. These two 250-gal. tanks are provided with valves near the bottoms from which heavy oil and residue are drained.

The system of reclaiming brass cutting oil does not differ greatly. The oil piped from the separators *A*, flows in the primary settling tank *K*, where it is heated by a steam coil for the same purpose as the steel cutting lubricant. From this primary settling tank, the oil is piped to two secondary settling tanks *H* from which it flows back into the service tank *C*.

This reclaimed oil shows very little deterioration. The loss in both steel and brass cutting oil through settling and sterilization is very small, in fact it is estimated that fully 90 per cent of the oil is recovered.

The Route Through the Shop

Practically all oil received at the plant is delivered in tank cars. The arrival of each tank car is reported to the chemical laboratory. The chemist inspects the car, measures the oil and also takes a sample for analysis. One copy of each laboratory report similar to those shown in Figs. 5 and 6 is forwarded to the office of the works manager, another to the office of the assistant superintendent and master mechanic, a third to the purchasing department and the fourth kept on file in the chemical laboratory.

Adjacent to the central station and located under the floor of the building are five oil storage tanks, *N*, *O*, *P*, *Q* and *R*, Fig. 3, varying in capacity from 9,300 to 15,000 gal. These tanks are used for the storage of new oil as it is received from the tank cars on the railroad siding at the plant. This oil is piped from the tank cars through a 4-in. main placed in a tile duct. At its siding end there is a flexible hose connection to enable the piping to reach the car. At its inside end, the 4-in. main enters a 4-in. header and from there the flow of the oil is directed into the storage tanks, the nature of the fluid governing the tank into which it is finally directed by control valves. Control of the oil in these storage tanks is directed from the central pumping station, Fig. 7. This oil can be pumped out for use at the main station or pumped into the service tanks.

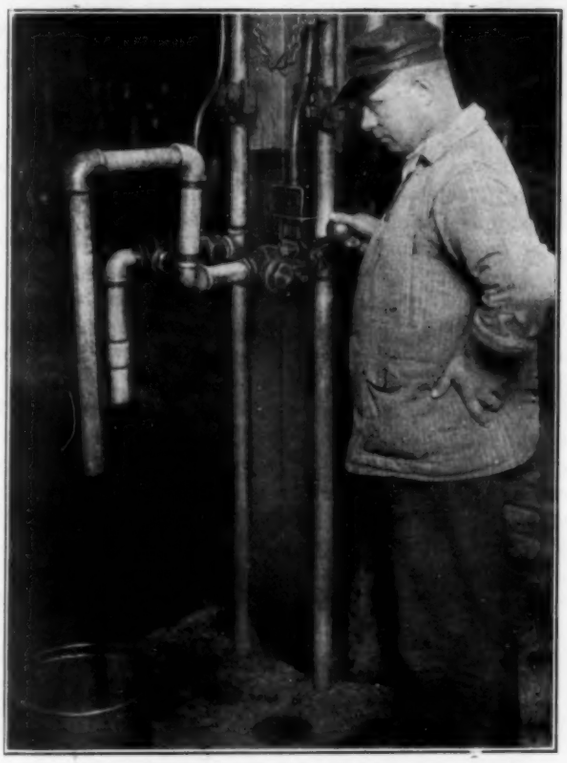
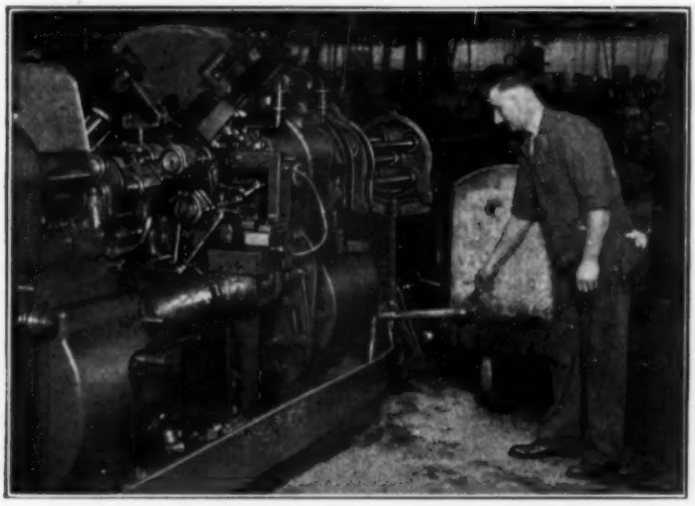


FIG. 8. AN OUTLYING DISPENSING STATION

At the opposite side of the reclaiming plant, there are located underground, the five oil service tanks, *C*, *D*, *E*, *F* and *G*, Fig. 3,, varying in capacity from 3,300 to



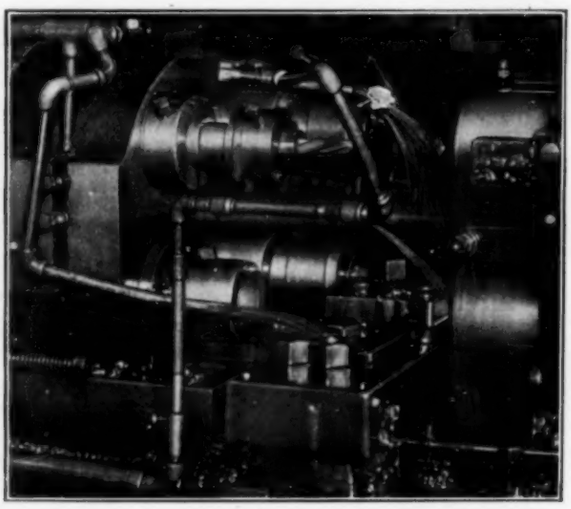


FIG. 9. REPLENISHING AN AUTOMATIC WITH OIL. FIG. 10. THE FIVE OIL STREAMS ON ONE OF THE AUTOMATIC MACHINES

5,950 gal., from which oil is pumped to the outlying disbursing stations.

On the floor above the reclamation station and storage plant is located the main pumping station for lubricants. The work of this station is greatly reduced by a system of twelve outlying disbursing stations suitably located in various parts of the plant. At these outlying stations, one of which is shown in Fig. 8, both steel and brass cutting oil is dispensed. The flow of the oil is governed by a remote control valve which, when opened, starts one of the electric pumps in the central station and causes the oil to flow.

The work of the outlying stations is supplemented by the oil distributing tanks (Fig. 9) mounted on wheels which are filled either at the central station or one of the outlying stations and used to replenish the supply of lubricant in the automatic screw machines.

How Far Should Drafting Cost Records Go?

BY L. J. SPINNER

Our drafting force of six men handles a wide range of work along the line of textile machinery. The factory seldom builds more than two or three machines of the same model at one time, and most of our orders call for modifications and variations of our standard types. This involves more drafting work than is usual in a plant of our size. In addition, we are designing a line of new machinery preparatory to entering a special field. Many of our machines are sold from sales drawings made up especially to show some new feature put out to meet a manufacturing condition in the customer's mill. A time clock is installed in the drafting room and job cards are provided which must be punched at the start and finish of a job. Reorganization of the shop has emphasized the value of job time records and has introduced the question of the limit of detail to which drafting cost work should go. This is a matter which I have never seen discussed in a technical journal, and I am sure that other shops are keenly interested as we are. In the hope of provoking discussion, I am submitting herewith my views which I transmitted to our office manager in the following memorandum:

I wish to discuss this matter at some length, as I believe we differ as to the degree to which job time-keeping should be carried in this department. Elapsed time records such as our job cards give, are useful in that they provide a ready means for charging time spent on a job. This is their primary function. In addition, however, they assist in the control and management of labor in so far as they give a comparison of present and previous times for doing similar work. In the drafting room it has been proposed to fill out separate cards for designing, detailing, tracing, and checking individual pieces, thereby giving a record corresponding to the separation of shop operations on a piece. I shall attempt to show that such great detail gives information of no greater value for cost purposes or for supervision, than does a much less complete record which gives the combined time of a man performing two or more operations.

In our organization draftsmen are called upon to design, detail, trace, check, compile parts lists, investigate special problems, answer customer's inquiries, blueprint, file, etc.

(1) New machines are often designed, which require considerable study of manufacturing processes, etc.

(2) Our men are often called upon to design machines similar to those of our regular line. In such cases, experimental and operating data are available. Occasionally, the work is no more difficult than that of laying out a left-hand machine from a right-hand.

(3) Parts of existing machines, which are redesigned to improve the operation of the part, to correct errors, or to increase the range of the machine, often present as many difficulties as the design of an entirely new machine.

(4) The design work of the preceding paragraphs may be either finished layouts, complete, and ready for detailing, or preliminary work such as proposal drawings, etc., which are really pictures, and in which the details are not fully worked out. In our work, a preliminary layout does not usually represent more than 10 per cent of the labor that a finished design does.

(1) This work may be done by the layout man working from his own design. The overall time for designing and detailing is least by this method when the details are not too great in number. While this is the quickest method, the saving in time is usually overbalanced by the higher rate of pay of the designer.

(2) The usual arrangement is for a detailer to work from a designer's layout. Depending upon the degree of completeness of the layout, the detailing may range from mere copying to actual minor design. The time required varies from that of simple measuring to that of working out methods of construction, machining, attachment of the piece, oiling, etc.

CHECKING

Among other things, the time necessary to check drawings depends upon the complexity of the machine, the familiarity of the checker with the intent of the designer, and the care and skill exercised by the designer, detailer and tracer. Every line, every dimension, every note on a drawing must be checked and measured. It is plain, then, that a checker's labor depends upon the skill, care and habits of thought of others, and upon the conditions under which others worked, whether interrupted, hurried, etc.

Tracing is largely mechanical except when complicated by the correction of scale, by rearrangement, etc. When a detailer traces his own work, it should result in greater speed, since he already has an understanding of the functions and individualities of the piece.

A draftsman does two distinct kinds of work. One is the drawing of a certain number of lines on a square foot of paper; the other is the thinking of what lines to draw. As a man goes up the scale from tracing, the occupation of thinking requires more and more of his time. I presume it is fair to say that less than 25 per cent of a designer's time is represented in the lines of his final layout. There is hardly a problem of design or detailing which does not involve some degree of invention. Would you measure inventive ability by the square foot of drawing? Or with a time clock? It seems to me that the only useful purpose of job time records in a drafting room is that of charging labor to the proper order. Dissimilarity of work wipes out all possibility of analysis and comparison and therefore, the simplest record possible is the most valuable. For this reason, I suggest that all of a man's work on a particular group of assembly, whether it be design detailing, checking, or a combination, be recorded on a single card with a single *overall* time record.

How Simplification of Product Widened Our Market

Saving Time and Money by Standardizing a Product—Educating the Consumer to the Use of a Standard Tool

By FREDERICK H. PAYNE
President, Greenfield Tap and Die Corporation

OUR business would not be at all the thing that it is today, if it weren't for the process of simplification which makes our large manufacturing unit much more efficient than it would be if we were making a multitude of designs as was the case forty years ago. Simplification increases our market, and at the same time allows us to use ordinary trade channels of distribution intensively and economically.

Four or five shops under different management sprang up at Greenfield and were competing with each other. Each shop had different designs, some of them based on talking points, which had to be kept up because the existence of each shop seemed to depend upon the uniqueness of its product.

Years ago every man who made a screw thread made it according to his own idea. Each manufacturer also took orders from a thousand customers, any one of whom might draw another unique specification for his own thread. When a manufacturer of mechanical products discovered that a competing manufacturer had a thread like this, he would immediately change his design, so that the final customer wanting a repair part for his machines couldn't accidentally order it from B. What schedule could be lived up to in making a product under these conditions?

Not only was each screw thread different from every other, but when made in such an irregular way, each thread was likely to be irregular within itself. Consequently one part of the screw might bind while another was loose. Quality was an unsolved problem.

Even while our shops were still competitors, they discovered that special product very seldom means excellent product, but does mean cost. An educational campaign was carried on among manufacturers and consumers and the resulting simplification has been of great benefit to the whole industry.

When the Greenfield Tap and Die Corporation was organized out of several of these Greenfield shops, the combined company at once proceeded toward still greater simplification. It assisted in simplifying the technical aspects of the product, and then sought to reap the benefit in economy of manufacture and sales. The lines of all the shops were pooled and redistributed so that each shop makes all the orders for one kind of article, without duplicating activities as formerly. This allows quality production and the development of special skill. All the branches of the former shops were also gradually merged into one common trade mark which helps sales momentum.

The merchandising of our product is sharply divided between simplified lines and special or miscellaneous complex lines. Only the regular or simplified lines are merchandised through jobbers in the ordinary sense. A jobber keeps a stock of these. Special goods are merchandised only through the catalog. Every page of our catalog describes prominently whether the goods are regular or special. If they are regular they can be had from the nearest jobber. If they are special they must be specially ordered either through the jobber or direct from the factory.

The jobber who handles such goods receives a great benefit from each step toward simplification of lines. He reduces the amount of stock necessary and increases his turnover and annual profits. He saves time in taking inventory. His errors in packing and in clerical work are reduced.

Simplification reduces the salesman's time used in visiting each prospect. It simplifies what a customer wants, and does most of his choosing for him. Each salesman gets an increased volume of business with no more bother. The commission on sales and the cost of sales are now much smaller percentages of total price than several years ago.

Some jobbers have adopted on our recommendation a maximum and minimum system of keeping stock and reordering our goods. As soon as the stock of one item reaches a minimum, they re-order a standard quantity. This saves them time in estimating their needs. The order quantity is an even number convenient for us to pack, and for the jobber to keep account of.

Where this method is developed completely, it makes some of our selling automatic. Our salesman can devote his time to constructive salesmanship. The jobber co-operates with us in inducing customers to purchase regular goods instead of insisting on special designs. He realizes that a jobber is always helped by standardization. Moreover, unique designs are not returnable, of course, and if the jobber's customer has ordered a special kind, and then refuses to take it, the jobber must be responsible. Whereas if the goods are standard an adjustment is possible.

The savings to the jobber, just described, are multiplied by three for the whole industry, taking in the manufacturer on one end and the consumer on the other. For the consumer also needs to keep a certain stock of tools, which though small, is important to him. The farther we carried simplifications the fewer tools he needed to keep to cover the variety. To many small consumers the expense through actual wearing out of tools used to be very small. They would not have enough jobs of the same kind to wear out a tool in a lifetime. The tools were much more likely to get lost than worn out. The big elements of expense were the first cost plus the replacement of losses. The wider the variety of pieces the less frequently each was used, and in the intervals the more likely each was to be lost. Under the consolidation of designs, each piece can actually use itself up. In fact, we teach customers how to re-sharpen the tools repeatedly. So the cost per job to the consumer went down.

Many consumers used to prefer to make their own special tools as needed. As our product came into use

in parallel with these home-made articles, however, they saw that our product was not only cheaper in price than the shop cost of their own, but was of better quality, would do more work, and be surer to do it. So they began to order their special taps as well as their regular ones from us. Our business has doubled even in special taps, though we have made that only a detail in comparison with our regularized lines.

Simplification made it possible for us to keep a large stock of finished goods in a central warehouse near the plants, directly under the main office. This ample stock has a remarkable effect on the speed of service to the customer, and at the same time it cuts down our clerical expense very greatly. The average article can be picked immediately out of stock, and shipped from the customer's original order without retyping, within a day. The shipped order is the only acknowledgment necessary, and the bill the only correspondence, whereas if an article is not in stock when ordered, as a special article cannot be, the correspondence department writes to the customer, the order department sends an inquiry and a follow-up to the factory as to the date of delivery, and a tickler file on promise dates has to be established. The original order retyped goes into a hold file, waiting to be matched against the factory order on its return. Meanwhile the correspondence department may have to answer one or more inquiries. All of this costs money and takes time. Accumulation of a more complete stock has cut the clerical force considerably, and the remaining force is now sufficient to take care of full business in ordinary times.

We get a constant comparison between the economy of simplified lines and special lines. We notice that every advance in simplification reduces the cost of packing and clerical work.

We did not abandon the business in special goods, but kept it, and used it to build business, in two ways. We wish to remain in such a position that a customer can get anything he wants in screw thread tools, regular and irregular, from our one company. So he turns to us as not only a dependable source, but an authority. Since we make all kinds, he believes us when we tell him that he may have special goods from us if he wants them, but that it will be much more to his advantage to select from the simplified lines.

Our salesmen are trained to examine special orders, find the use to which the goods are to be put, and, if they can do so tactfully, suggest the nearest standard size and point out the economy that would result to the customer if he could change to that size. Very often such a change is not only possible but advantageous in innumerable other ways in addition to immediate economy.

It is not necessarily a sign of intelligence to invent your own specifications. First, it quadruples the price. A small regular tap may cost only 35 cents, because it is run through in large quantities, while another tap exactly like it in appearance, except that it has one more thread per inch, might cost $1.50 to $2, and would take two weeks to get, instead of being picked out of stock. Moreover, its usefulness to the customer won't be nearly so great as if he had selected from the simplified line, because the product won't be interchangeable with anything else in his shop or his motor car.

The education of the trade has progressed so that 50 per cent fewer special orders are now made than ten years ago, in spite of the very great increase in the total quantity of goods.

Simplification destroyed some old products but it has also created some new and better ones. We were able to design a die which is much superior to our old ordinary die, but which must be constructed in an expensive way. The increased expense is justified only by the fact that instead of cutting say a thousand threads during its life the new product will cut many times that number, in some cases a hundred thousand. The purchaser couldn't afford to use such a tool if he did not have sufficient threads of that size to cut, and he has that number only because the public has been educated to use standard sizes for many various purposes.

Each new product we develop is in the direction of better quality. For the first cost is not so important to the customer now that each product can cover a great variety of work.

There is also a continual improvement in the quality of standard product. We now make the very complicated dimensions of threads accurate to a ten-thousandth of an inch if necessary, and to a thousandth as an ordinary manufacturing proposition, as contrasted with the former variations of several times that amount. This same accuracy is now applied to special goods also, of course, but it was the wide market and increased production fostered by simplification which allowed the expense of engineering investigations and development of necessary tools for the higher fields of accuracy.

Our shop early discovered that to keep our product uniform we needed tolerance gages, and soon we began making and selling these gages among our customers, so that they could measure their own product. We quickly discovered a considerable market for simplified standard dimensions, or interchangeability, which was the real thing we were selling in connection with gages. This market has grown and is still growing.

Recently a firm of motor car manufacturers organized and considered what it would need to start a factory. The manufacturers asked, "What is the greatest essential to our business?" and the answer was, "Standardization of dimensions, interchangeability of parts." Consequently the company bought $50,000 worth of gages right at the start, as naturally as it would spend a like amount for a permanent building or machines. It knew from the experience of other companies that interchangeability was its greatest need, not only in the product this year but between the product of different years, for many years ahead.

Quantity manufacture of the simplified lines taught us how to apply certain lessons of simplified handling to special lines also. The essential parts of the product may be unique, but the over-all dimensions may be common, such as the length of the whole article and the length of the threaded part. We analyzed the annual sales in quantities of each special product. Then we grouped certain dimensions which are so nearly the same that they can all be finished from the same size of partly finished blanks. Then we made group tables showing which of these blanks we could afford to partially prepare in quantities for stock. We quickly finish the blank in the particular form desired by the customer. This method is not as good as the regular quantity production from start to finish which is used on simplified goods, but it has reduced the cost of certain special products.

A special tap now costs less than did a regular tap years ago, when practically all so-called regular taps were really made on what we would now call special orders.

At first, the industry and the trade associations and organizations interested in simplification had to carry on a strong educational campaign, which has not yet ceased. As the use of standard goods spread among the public, standardization took on momentum and grew of its own accord.

Now when we are considering getting out a new product, we always ask the question, "Will it fit in with the simplified and standardized lines which the public has adopted as a policy?" For in a world that is being simplified, we do better business by truing up with the universal habit.

A Unit System of Tote Boxes

BY FRED ALBRECHT
Office Manager, Lodge & Shipley Machine Tool Co.

One of the problems of the large manufacturing plant is the rapid and economical transportation of materials, both raw and finished, from one department to another. It is, of course, recognized in every well-managed establishment that, to prevent loss of time in any department, it is absolutely essential to keep the work moving between operations.

After much experimenting with various methods. The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, manufacturer of lathes, has adopted the plan of using specially designed platforms and trays which can be built up to any desired height. These "tote boxes," as they are termed in shop parlance, are used in connection with elevating trucks, the clearance under the platforms being just sufficient to accomodate the trucks. When the loads are rather heavy electric tractors are used for hauling.

In Fig. 1 is shown the construction of the platform and the tray. The platform is built of two 2 x 4 x 36-in. yellow pine timbers, to which two layers of ¾ x 5-in. yellow pine sheathing are nailed. The first layer is placed crosswise and is 24 in. wide. The upper layer is laid lengthwise and is 36 in. long. The corners are supported by cast-iron feet, each fastened by eight large wood screws. The design of the feet is such as to afford a solid support for the 2 x 4 in. timbers, as will be seen in Fig. 2. The feet extend ¾ in. above the floor of the platform, providing solid right-angled corners into which the tray is very easily fitted

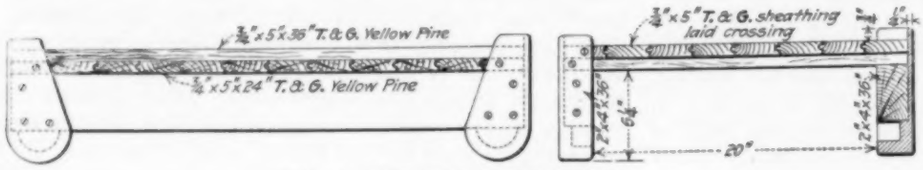


FIG. 2. DETAILS OF PLATFORM

FIG. 1. PLATFORM AND TRAY

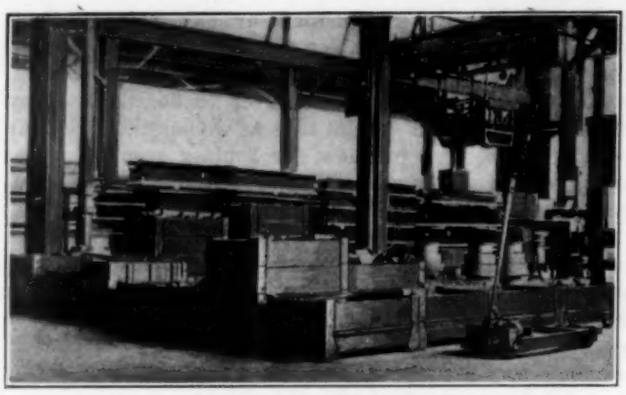


FIG. 3. TRAYS NESTED TO FORM BOXES OF VARYING HEIGHT

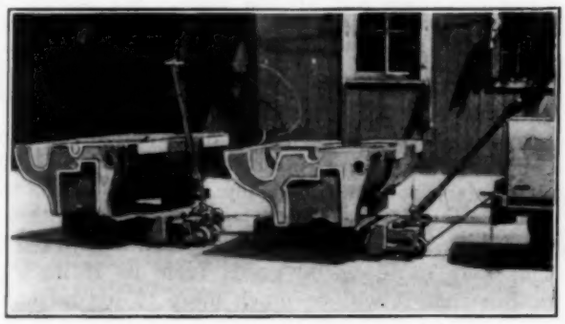


FIG. 4. HEAVY WEIGHTS TRANSPORTED ON PLATFORMS

The tray is made of ⅞ x 8-in. poplar, of the same over-all dimensions as the platform. The sides and end pieces are rigidly held by angle irons of the same height as the boards. These irons are screwed into place in such manner as to allow the bottom of the tray to fit into the corners formed by the platform feet, and to provide corners at the top to hold the next tray. As can readily be seen, the trays may thus be placed one on top of the other with perfect security, as shown in Fig. 3. When not in use the height to which the trays may be stacked is limited only by the height of the storeroom ceiling.

An idea of the strength of the platform may be had from Fig. 4 which shows an electric tractor hauling two elevating trucks coupled together, each carrying a platform with a 36-in. lathe headstock casting weighing 1,975 pounds.

The use of the "tote boxes" permits materials to be stored in any location until wanted, and the ease with which the boxes can be picked up and moved saves considerable labor and expense.

The Prodigious Cost of Industrial Accidents

Statistics on the Cost of Accidents—Instances of Reductions in Absenteeism and Monetary Losses—Examples of Simple but Efficacious Safety Methods and Appliances

BY SANFORD DEHART
Director of Hospital, R. K. LeBlond Machine Tool Co.

OVER a billion dollars a year. This is the stupendous sum, which statisticians figure industrial accidents are costing this country annually. There are 22,000 workers killed and 600,000 injured each year. The 600,000 injured are of a major character and incapacitate the worker on an average of four weeks a year. On a basis of 300 working days, of eight hours each, this country has the unenviable record of having a workman killed every six minutes, and one injured every fourteen seconds. Is it any wonder that one statistician dubbed us the most careless people in the world?

It is almost inconceivable that 1,000 persons should be killed each year in the United States by simply falling off ladders, but it is nevertheless true.

It is estimated that 15,000 persons in the United States are at the present time blind as a result of industrial accidents. The financial cost for maintaining these workers is $10,000,000.

In 1919 Wisconsin alone had 14,495 industrial accidents per month, or about one accident every twelve minutes during working hours. There were 2,870,438 days lost, but this total is incomplete for the reason that it does not include the cases involving a disability of less than seven days. There were thousands of minor cases which did not extend over the minimum period of one week. The compensation for indemnity and medical aid for the year, reached the princely figure of $2,163,354 for the year. The average time lost was 192 days. The indemnity and medical aid averaged $144 per injury. S. W. Huels, educational deputy of the Industrial Commission of Wisconsin, in an article in the "National Safety News," says that the 1919 accidental death and disability record is the worst in the history of the state.

High frequency and severity accident cases are not confined to Wisconsin. From July 1, 1918 to June 30, 1919, Massachusetts had 178,045 accident cases reported. There were 5,178 cases of infection, of which 19 died. Compensation for injured employees cost $5,219,760.24. Approximately $401,921.57 was paid out for infections incurred during this period.

Pennsylvania had 668,340 accidents and 9,143 deaths, during the years of 1916, 1917 and 1918, for which the cost was $9,158,833.

California had 100,000 accidents reported and 440 deaths from July 1, 1919 to June 30, 1920. Compensation was awarded 25,754 cases and amounted to $5,621,-828.

For the year ending July 30, 1919, New Jersey had 350 deaths and 17,304 non-fatal accidents reported.

The lost time due to accidents in these five states represents the productive capacity of 39,000 men working a full year. These states are fairly representative of what is occurring in other large industrial states.

To suggest accident reduction is not to theorize fantastically as the following statement will show: the accident mortality rate in the United States in 1914 was 2.8 per thousand workers, while in Germany it was only 0.68 per thousand.

What is this great Moloch that causes so many industrial accidents? A recent investigation shows that accidents are due to man's failure and not directly chargeable to machinery. In a survey made last year by a large automobile company, it was found that fifty per cent of the total accidents was neither the employee's nor the employer's fault. Thirty per cent was due to the employee's fault, ten per cent was due to a fellow worker's negligence, and the remainder was chalked up against the company's fault.

It makes no difference in most states who is to blame for accidents; the fact that the injured was employed at the time of the accident is prima-facie evidence that he is entitled to compensation.

SAFETY WORK ECONOMIC AND HUMANE

Realizing not only the economic but the humane importance of safety work, a great many of the larger corporations have gone into accident prevention work on a colossal scale. The United States Steel Corporation is spending a million dollars a year for safety work to protect its 270,000 employees. Between the years of 1906 and 1912 this company reduced its accidents 43 per cent, and in the past fourteen years has saved over 29,500 of its workers from accidental death. It is conservatively estimated that 1,034,250 days were saved as a result.

Other concerns which have reduced their absenteeism due to acidents are the Raritan Copper Works, 81 per cent; Pennsylvania Salt Manufacturing Co., 93 per cent; and the Four Wheel Drive Auto Co., 83 per cent, in the past two years. Another company invested $6,000 in safety and saved over $14,000 in doctor's bills and compensation payments, and as a result saved 310,000 hours of labor in one year, or the equivalent to the production of more than 300 automobiles.

The safety department of the Colorado Fuel and Iron Co. was able to keep its fatal accidents down to one death to 296,515 tons of coal produced. Other mines in the state of Colorado, not operated by the Colorado Fuel and Iron Co., had one fatal accident to every 146,628 tons produced.

The Pennsylvania Railroad Co. has spent enormous sums in the safety movement. A report that I saw recently showed where they had reduced acidents 63 per cent.

Accident prevention is curious in its manifold angles. For instance, a factory employing many thousand persons considers $2,000,000 a year spent on keeping the plant clean a good investment. They are of the opinion that cleanliness and safety are analogous. Another instance is that of a manager of a machine shop, who was experiencing considerable trouble with a department in which several boring mills were located. The employees were reluctant to work in this department, because they were suffering from acute respiratory conditions, superinduced by inhaling the dust of this department. The company installed a blower system costing $12,000 and all complaints ceased, and as a

result the labor turn-over of this department was considerably reduced. If you have read this far you will say, "That sounds all very well for the big corporations, but where does the employer come in who is employing less than a thousand persons?" The company with personnel of less than a thousand has an easier proposition with reference to accident prevention than the employer who is employing many thousands. He has two great advantages over the large employer, viz., the personal touch, and a knowledge of the idiosyncracies of the employee. Take the R. K. LeBlond Machine Tool Co., as a concrete example. They have normally on their pay roll one thousand persons. This company has never employed a full time safety engineer, and has never had an organized safety committee. Their accident rate is low. In fact, so low that two years ago during the busy time, they were able to hold their absentee rate due to accidents down to sixty hours, for a period of five months, among a thousand men. The total compensation paid out for accidents incurred during that period was only $6.25. In this connection, I might add that the LeBlond company operates under what is known as Section 22, Ohio Industrial Commission, by which the company is permitted to carry its own insurance.

FIG. 1. WASH ROOM, WHERE SAFETY LECTURES ARE GIVEN TO THE EMPLOYEES

Every foreman has been vaccinated with safety serum, to the extent that they are intensely interested in preventing accidents. The foremen have sprung up from the ranks. Most of the workmen have been with the company a year or more. Many of the workmen have been with the company over fifteen years, and what is most important, all of the employees speak English.

The employees are given safety lectures, generally being assembled in the wash room, shown in Fig. 1. These lectures are supplemented by bulletin board propaganda.

The apprentices are taught in the instruction room and the shop training room, Fig. 2, how to avoid accidents. Accident prevention in the LeBlond Apprentice School is considered one of the most important parts of the whole curriculum. When an apprentice's time has expired in a department, he is returned to the shop training rooms for intensive training, before entering a new department. This is what we call taking the "rough edges" off the apprentice. It has greatly minimized accidents among the apprentices. These youngsters have become so imbued with the safety idea that they frequently report to the hospital a hazardous condition, which has been unnoticed by the foreman. Like most great things, some of our safety appliances are absurdly simple, but exceedingly efficacious. For instance, a "Breathing Process or Suction Device," in our paint department, Fig. 3, rendered this department 70 per cent less hazardous, with reference to eye work

FIG. 2. ADJUSTING THE APPRENTICE TO HIS NEW ENVIRONMENT

and respiratory diseases. A small filtration and sterilizing plant entirely eliminated oil boils from the machine shop. An eye room and facilities for treating the eye, in connection with our hospital, reduced our eye cases from 5,016 to 742 in three years, and reduced the cost in these years from $1,052 in 1917, to $7.50 in 1920.

We have had but one infection in three years and it did not terminate disastrously. In this connection it is hardly possible to over-estimate the importance of prompt and efficient first aid to shorten and minimize the effects of accidents. We have used Mercuro-chrome 220, a preparation developed at Johns Hopkins University, with considerable success as a prevention of infection. It possesses all of the advantages of iodine and none of the disadvantages.

Change of Environment a Benefit to the Employee

The LeBlond company is of the opinion that the employee is benefitted mentally and physically by a change of environment. Proceeding along these lines, they have provided ample recreational facilities, such as a swimming pool, recreational park, orchestral entertainments, motion pictures and the different games, this list being more suggestive than exhaustive. Most

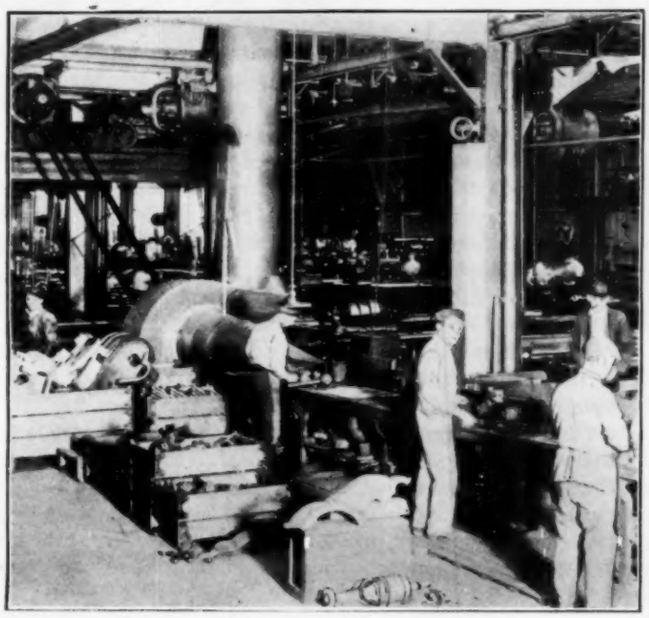


FIG. 3. SUCTION APPARATUS REDUCES HAZARDS IN PAINT DEPARTMENT

of these recreational activities are pursued during the noon hour.

That a change of environment has an important bearing on accident prevention is attested by the fact that our records show that we have not had a single serious accident for the past five years, between the hours of one and two-thirty p.m.

It is interesting to note in connection with accidents, that the LeBlond company has had only two deaths in the history of the concern, which was established in 1887. The major injuries are few and far between. The company has had occassion to send only one man to the city hospital in the past ten years.

In compiling this article, I have not attempted to formulate a panacea for the prevention of accidents, as I fully realize that it takes more than two bones to make a dinosaur. But we must not lose sight of the fact that a coral reef starts from a very small insect.

Non-Productive Costs

By A. L. De Leeuw

There is, perhaps, no more unthankful task than to call attention to terms which are misused. It does seem very much like splitting hairs to point out that a term or phrase which we all know is, after all, not correct. It seems so non-essential that we are instinctively inclined to shrug our shoulders and consider the thing not worth while wasting our time on. And so I hesitated before I finally made up my mind to say something about the series of comments on an editorial that appeared in the *American Machinist* under the heading of "Non-Productive Costs." I felt again the effects of an old grudge which I thought I had cast off. That word "non-productive" always irritated me, probably because I have always been a "non-producer" myself.

Before anyone starts shrugging his shoulders, let me say that this old grudge of mine would never have induced me to write about it if it were not that "non-productive" is taken at its face value, not merely by the casual reader but by a large percentage of business managers. Of course, many readers will say, "Well, we all know what non-production or non-producer means, and we are making allowance for it," but are we? My own experience leads me to believe that we are not, at least, not always; and that it is about time to throw the term overboard and substitute other terms which we can use without danger of being misled.

Though fully in agreement with practically all that was said in these various comments, I am struck by the fact that the various writers on the subject have, to a large extent, entirely different things in mind about which they are writing. Take, for instance, the article by C. R. Snoke, and particularly the latter part of it. No one will disagree with him that we should not be extravagantly using telephone calls, telegrams, office supplies, etc., and I, at least, fully agree with him. But all these things he mentions do not come under non-productive costs, because they are not *costs* in any sense of the word. They are merely expenses.

If I buy a tie for one dollar and drop a dime while I am pulling out my money, can I say that the tie now costs $1.10? In my opinion the tie cost one dollar and I have suffered a loss of ten cents. If a manufacturing concern has $20,000 in cash in a certain bank and the bank fails, can it be said that the cost of production has gone up $20,000? In my opinion, it cannot. The concern merely suffered a loss. If the employees of a concern have the habit of using telephones freely, thus necessitating the installation of an extra trunk line, can it be said that the manufacturing costs have gone up? In my opinion, it cannot. There was no increase in *costs*, but there was an increase in *expenses*.

Thoughts along an entirely different line struck me when I read the comments by R. E. Flanders. Here again I agree with the writer. He points out that the labor cost was very much less than some other expenses and that, therefore, these other expenses were the most promising field on which to hunt for economies. But this does not prove that there were any real non-productive costs. Maybe there were, maybe there were not; the article does not point this out.

It seems to me that much good could be accomplished if all of us were to think and talk on this important subject of economy in the shop in the same terms and phrases. If we define the word "costs" to mean all

expenses which go into the manufacture (or manufacturing, handling and selling) of a product, then there cannot be any non-productive costs, but there may be non-productive expenses. If we define things this way, then of course we will all agree immediately that non-productive expenses must not be *cut down* but should be *cut out*. The fact that all other expenses are costs, that is, that they are really incurred in the manufacture of the product, does not necessarily mean that they cannot be cut down. Nevertheless, all such expenses are productive costs; they may be *more* or *less* productive. It is up to the managers to select the most productive methods, that is, those methods which will give the greatest amount of results with the least amount of expense.

As I said before the great objection to the terms "non-productive" and "non-producer" is the fact that so many managers take these terms at their face value and as a result they go with might and main after the non-productive costs and non-productive labor, and they keep constantly before them a comparison between the amounts of money spent for productive and non-productice labor. Many managers think that if the percentage of money spent for non-producers becomes greater as compared to that spent on direct labor, there must have been a step backward. Now, as a matter of fact, our entire industrial development has been in the direction of increasing this percentage of overhead and future development will lie in a still further increase. We would not willingly go back to the Egyptian method of building or even to the methods of as early as fifty years ago when overhead was quite small. Our best engineers, our keenest managers are always on the lookout for a reduction in the amount of direct labor or skilled labor required for an operation. They accomplish this by substituting machinery or less skilled help or special tools. In other words, they substitute non-productive for productive costs and, of course, their aim is to reduce the total.

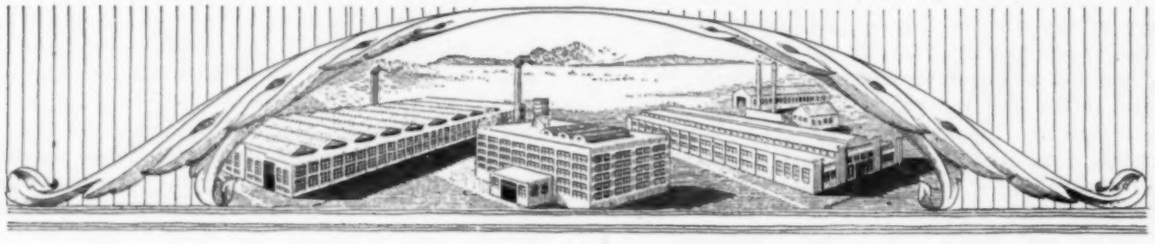
Not so many years ago, if we wished to keep a stock of coal on hand we would get a carload on the ground, send a man with a shovel to the car and have him shovel the coal out. We were not able to pile it up very high and needed a large amount of ground for a moderate amount of coal. When the coal was needed in the power plant we sent somebody out, possibly with the same shovel, and a wheelbarrow and had him wheel the coal into the boiler room where it was dumped on the floor. Another man with a shovel would then dump the coal into the furnace. This was practically all direct labor and no overhead. Now we use a coal-handling device. The mere pulling of a lever dumps the coal, an electrically controlled device piles it up, and another device carries it into the boiler room, lifts it up, puts it in the storage bins, from where it is automatically taken to the grates, with practically no direct labor. The direct labor cost in this case is almost nil, the overhead several thousand per cent. Does the fact that the overhead is so enormously high induce us to go back to the old system? Not at all, because we realize that the overhead is high simply because the direct labor is low. Now, after all, the manager should be concerned with the final costs only, and not with the proportion between the elements of this cost.

Apparently then, Mr. Snoke is thinking of useless expenses while Mr. Flanders is considering indirect labor and possibly indirect materials. The writer of the editorial in the *American Machinist* which provoked the various comments seems to have had something different again in mind. He was probably thinking of selling expenses, advertising, displays, and what-not. Such expenses are truly non-productive from the standpoint of the shop, but they may or may not be productive from the standpoint of the business as a whole. As a rule it is very easy to say whether expenses incurred in the shop are productive or not; it is not so easy to say the same about expenses incurred for advertising, display, etc. Such expenses are more or less of a speculative nature. When a new display room is opened it is always doubtful whether it is going to be productive, and, if so, whether it will be sufficiently productive to justify the expenses. Of course, the manager hopes and even expects that this will be the case, but he cannot be sure about it. On the other hand, he has means of finding out whether certain improvements made in the shop are productive or not. Notwithstanding the fact that advertising, etc., is of a speculative nature we should not consider the money spent for it as a non-productive cost, because if we did consider it such we would cut it out. However, I do think that the expenses of the shop and those of the sales department should be kept entirely separate, and that for the very reason that direct results are observable in the one case and not in the other.

There is another reason why I strongly object to the term "non-producer" and that is that it casts a slur upon the effectiveness of some of the most valuable men in an organization. Not only that, but it provokes the idea among those men who perform the direct labor that all other men in the organization are more or less parasites. I have often wondered lately how much of the Bolshevik ideas prevailing at the present time are due to this misnomer—"non-productive labor" or "non-producers."

I would suggest that we speak of direct and indirect labor and material, and that we do so in the sales department as well as in the shop. In addition to these four items, we would also have the item of general overhead.

Any other set of terms which would express the real meaning of the things they are supposed to indicate would be equally acceptable to me; but I do wish we would get away from the term "non-productive" except when we intend to indicate *rank waste*.



Salvaging Industrial Wastes

Metal Wastes—Salvage in Maintenance and Repair—Advisability of Permanent Reclamation Service—Importance of Saving Time and Human Effort

By J. A. SMITH
General Superintendent, General Electric Company

THE term "salvaging" has become a world-wide slogan. Industrial managers are studying operating conditions as never before in the history of business, and among the various phases of the subject which relate to the reduction of operating expense, the salvage of factory wastes comes in for a large measure of attention.

Let us first consider the question of salvaging metal wastes—for every factory in the country manufacturing a mechanical or semi-mechanical product produces metal scrap of one kind or another. It is essential that a system be set up whereby the various grades of metal chips and turnings will be kept separate in the shops during machine processes in order to save time and labor sorting and segregating in the scrap or salvage department. Non-ferrous metals should always be kept separate from steel and iron. When the parts machined consist of a non-ferrous metal with steel or iron, the chips should be run through magnetic separators.

In some of the bigger industries, chips and turnings are pressed into briquets of suitable cupola size, but this practice has not as yet become general throughout the country, and is carried on chiefly where the tonnage of chips and turnings is normally large. The process results not only in higher market value, but also in a material saving in transportation charges. Sheet-metal punching scrap, metal strips, trimmings, wire, etc., should always be put up in bundle form and in cupola size before being loaded for shipment, for the same reasons.

All the various classes of miscellaneous scrap metal, such as cuttings and trimmings from bar, rod, and heavy sheet stock, small castings, forgings, and solid pieces of every kind, should be accumulated in separate containers in the shop, for this class of scrap has a higher market rating than is obtained for chips and turnings.

Laboratory processes are often productive of valuable wastes either in the form of metals, such as tungsten, molybdenum, etc., or in the form of various chemical residues which may, through conversion or combination, become the basic elements of new preparations and compounds.

There is a wide variety of miscellaneous wastes which require our attention, and in this field a great amount of salvage work can be profitably done. Lumber, boxes, rope, rubber, fiber, cotton and woolen fabrics, cotton waste, paper, insulation materials, chemicals, etc., constitute some of the items which can be salvaged with profit in the modern industry. As an example, incoming boxes can be repaired and put in shape for future use either for storing materials, or as tote boxes in the shop. When too large to be suitable for these purposes, the lumber can be utilized for repairing and making tote boxes, temporary platforms, stagings, concrete forms, etc. The salvaging of lumber and making of boxes from this second-hand material in some of our large industries represents a saving of many thousands of dollars yearly in the purchase cost of new lumber. Even sawdust, usually considered of little value, can be used for the packing of porcelain and similar products, and the finer grades for the drying of metal parts in the dip shop. There is scarcely an item that we can name in the list of industrial wastes that has not some value either in its present state, or in the production of raw materials for the manufacturer's use. Even what is known as shop refuse may be burned in a destructor's plant under boilers, and produce steam for heating and manufacturing.

A careful system of segregation is essential in the salvaging of metals, as well as of all other kinds of factory wastes, and this should be carried to the highest standard consistent with local conditions and without defeating the purpose of securing the highest market prices by undue expenditure for labor and equipment. It is well to have all scrap weighed and credited to departments for the twofold purpose of correct acounting and inculcating an interest for salvage work in all department heads.

Salvage Work in Maintenance and Repairs

But we must carry our salvage work into other branches of shop activity, such as maintenance of property, repairs to machinery and tools, handling of stocks, and upkeep of all the various classes of small tools, including lathe and planer tools, high-speed steels, etc.; and here is where the expenditures in big industries begin to mount up to vast sums, to hundreds of thousands and even to millions of dollars, during the course of a year. It is essential, therefore, that systems be set up whereby all these items of maintenance will receive the most careful scrutiny and the expenditures will be adequately limited and controlled. Systems must be set up governing the distribution and repairs of the various classes of small tools so that the consumption of these will be regulated within certain defined limits of economy and efficient service, in accordance with production requirements in the shop. It is good practice to make regular monthly inspections of machine tools and equipment, and make a record of the same, in order that repairs may be made promptly at a minimum of cost before the damage becomes more serious or breakdown ensues with increased repair expense and added delay to production. The record is valuable as showing the relative cost of maintenance and relative life of service of various makes of tools. It is often good economy to replace a tool showing high maintenance cost with a new tool of some other make, and thus save both expense and delays to production. In all cases of replacements and repairs, valuable parts should be salvaged and made use of on other jobs of repair work, wherever practicable.

In the supply of small tools to the shop much can be accomplished in the way of reducing expense by efficient methods of distribution and collection. A system of regular inspection of toolrooms, tool cupboards, benches,

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and areas around machine tools should be established in all departments. Tools not needed for immediate or current use should be cleared up promptly and returned to stock, and those needing repair put into shape for further requirements. This is particularly important in the case of high-speed steel tools where the cost is relatively high by comparison, and a single idle tool may represent a good many dollars of tied-up capital. Nearly all the various small shop tools, such as wrenches, vises, hammers, drills, cutters, pliers, files, and numerous others can be repaired to good advantage and thus be made to give greatly lengthened service and reduce the number of purchases of new tools. By a properly organized system of distribution and collection the inventory of tool stocks carried may be greatly reduced, expenditures for new tools curtailed, and those in use in the shops kept more constantly in active service.

The subject of lubrication both of machine tools and of cutting tools affords opportunity for valuable reduction in the operating expense of the shop. With modern storage equipment and modern facilities for distribution to the shops, also proper feed pipes and oilers for regulating the supply to tools, a material saving in consumption of oils and cutting compounds can be made. Selection of oils is most important, and this should always be made with a view of reducing friction load on bearing surfaces and of keeping tools properly cooled and lubricated during the process of cutting, and not primarily in reference to cost. Valuable work has been done in recent years in the substitution of mineral oils and mineral lard oils for pure lard oil in a variety of processes where formerly pure lard oil was felt to be necessary. In fact, a heavy-body mineral oil of correct specifications will do the greater percentage of jobs commonly done with lard oil without any material increase in consumption, and with greatly reduced cost. A high-grade light-body mineral oil will also do many processes, such as turret-lathe work, milling high-carbon steels, etc. Soluble cutting compounds also have their place in machine-shop practice, and their use in a great variety of processes, such as drilling and milling, plain lathe work, cold cutting, etc., results in a greater economy than can be secured with oil. Attention needs to be given to the handling and distribution of oils in order to avoid waste. Machine tools should be equipped with proper tanks, drip pans, and aprons, in order that nothing may be lost. Reclaiming oil from production parts and from chips and turnings is a part of the salvage work of every up-to-date factory and need not be enlarged upon here.

We hear much talk these days on the subject of reducing inventory, and it is essential that the work be carried forward intelligently and earnestly in order to put industry on its feet. The present is the time to make thorough investigation of every department and storage space, and to gather up all surplus or idle materials and effort made to put them into service, or otherwise dispose of them to advantage. Analysis must be made of the methods of handling and distributing materials in order to establish improved systems, reduce labor, and avoid delay or damage. Special attention should be given to cutting raw materials to required dimension or multiples of required dimension in order to save waste; and to the salvaging of all left-over pieces and parts for further use in some portion of the factory, wherever practicable. For this purpose the central storehouse should act as a clearing house, and thus aid in the general work of salvaging.

The human element enters into salvage work, as into all other industrial operations. If we can get department heads, and employees as well, interested in saving everything of inherent value, we will perform a valuable service in helping to re-establish industry on a firm and stable basis. Not only industrial managers, but the public as well, are more and more becoming interested in this most vital of human problems. One of our big industries salvages annually, in normal times, more than eighty million pounds of factory wastes. The railroads also have caught the spirit of thrift and are establishing new practices which are showing greatly improved conditions as regards operating expense. The country at large in a recent year saved scrap, consisting of several items—metals, paper, rags, wool waste, cotton fabrics, etc.—aggregating more than one and a half billions of dollars.

In the years immediately before us, industry will be called upon to bear a large portion of the burden in the vast and arduous work of reconstruction. As engineers and managers we need, therefore, to be strongly imbued with the vital principles of economy and thrift, and with the importance of greatly increased effort along the lines of salvage work. The question of profit must not always be a deciding factor, but we must conduct our operations with a broader view of saving everything which may be of value to others in the production of raw materials or finished fabrics, whether we gain immediate, direct profit or not. The manufacture and supply of raw materials depends so often upon the supply of various kinds of scrap and waste that it is most essential we give consideration to the country's needs as a whole and do not limit our efforts at salvage work to our own desire for immediate profit. Indirectly we shall receive benefit through reduced cost of the raw stocks we purchase for our own manufacturing purposes because of the abundance of original materials which we have helped to create.

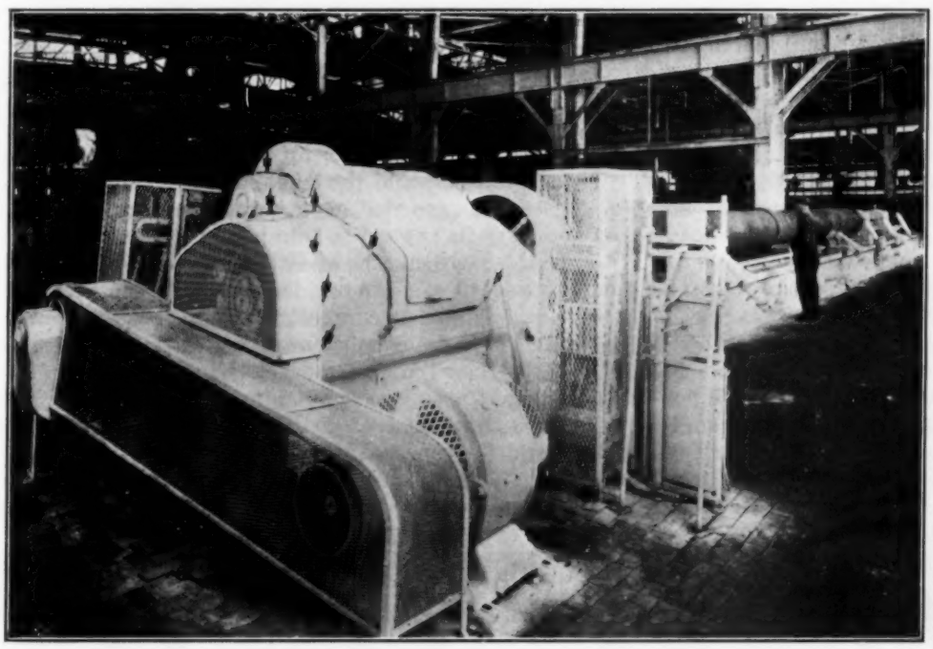
No appeal to the manufacturer to save the waste products of industry can be made too forcible or too strong, nor can we lay too much emphasis upon the necessity for every individual joining earnestly with us in this great work of universal benefit to the country at large. Every pound of junk saved at our homes and turned over to the junk dealer in the end reaches the great melting pot, and finally the marts of trade, in the form of raw materials to be of definite value to some one; and that one, incidentally, may be any one of us here engaged in the profitable manufacture of fabrics which serve a public need. The nations of Europe, through the very exigencies of the war, were forced to carry on the work of salvaging to its greatest limit in order to sustain the people at home and the armies in the field; and now, during the period of reconstruction, they appear to have doubled their effort and to have gone beyond this limit in the struggle to rebuild government and business and industry on a stable and enduring basis. We in America are gradually becoming more and more aroused to this big problem in our public and private life. We have been given to waste and extravagance in the past, but we are gradually awakening to the fact that it is not so important what we have or what we produce as what we are able to save and reclaim from all the various processes of production. What we need to learn as a nation and as individuals is the vital importance of practicing the simple precepts of economy and thrift and of guiding all our actions both in business and private life to that essential end.

We need to learn to save everything of inherent value, and in doing this we ourselves shall derive a benefit in the general public good.

We ought to have a permanent reclamation service, fostered and maintained by our National Government as other public services are fostered and maintained. Through this office practical appeal could be made to the governors of states, through the governors of states to mayors of cities and presidents of villages, and through these latter to the heads of boards of trade and to public-spirited citizens, to co-operate in the great work of saving the nation's waste. Through this channel also could be disseminated much useful knowledge and instruction relating to the work of reclamation, which would thus reach in a helpful way not only the populous industrial centers but the outlying districts as well, and by this means bring about a widespread, concerted action for the public good. No one may attempt to predict the full extent of the value or the aggregate return of such a movement to the Government and country at large.

A TOOL ROOM MADE LIGHT AND CLEAN BY PAINTING THE MACHINES WHITE

Still another phase of salvage work which is distinct and apart from the field of salvaging metal scrap and other factory wastes, is the saving of time and of human effort, the harboring of mental and physical energy, and the devoting of all our effort to the highest purposes and the highest aims. Profitable manufacturing requires that we build up our organizations both in offices and in the factory with a view of concentrating directive effort, eliminating duplication of orders and instructions, establishing unity of purpose, system in method of procedure, and co-operative effort on the part of all employees, whether serving in official capacities or in the lower grades of mechanical and physical labor.



A BIG MACHINE WAS IMPROVED IN APPEARANCE AND LIGHTING WAS INCREASED BY THE USE OF WHITE PAINT

The two illustrations on this page show the use of white paint under widely different conditions

It is essential that we organize departmental forces in such manner as will secure systematic control of all the functions of labor and consumption of materials, and the keeping of manufacturing expenses within the budget provided for conducting shop and office work. We must build our organizations with a view of attaining the highest standards possible, in order to re-establish business on the high plane of influence which it must always occupy in the successful upbuilding and support of our Government and nation, and in the permanent establishment of the normal pursuits of industry and peace.

How to Lower Coal Costs

The Importance of Proper Selection, Buying and Tests—Getting the Most Out of the Dollars Paid for Coal—A Few Notes from History to Aid the Coal Users

By C. E. LESHER
Editor, *Coal Age*

IT IS HARDLY necessary to say that when one buys coal he buys heat, but pays for coal, service and transportation. There are almost as many different kinds of coal as there are coal mines, and of the service that follows the coal from the mine to factory siding there is infinite degree and variety. Even freight rates vary, for the rate structure on coal is a wondrous creation with many quirks and turns.

So, to get the most out of coal costs the buyer must take into account quality of coal, preparation (the freedom of the coal from impurities), dependability of supply and freight rate, for it is delivered cost that goes on the balance sheet.

Selecting the proper coal for each boiler plant may be left to the hit-or-miss judgment of the boiler room foremen or the firemen, but the best practice today is to depend on tests by combustion engineers. The problem is not simple because the variable factors are numerous. Possibly the first consideration is the absolute limiting factor of fusing point of ash, which in turn depends on percentage of ash and of sulphur in the coal as received. If a low grade coal can be used, the field from which to select is much broader than where, because of furnace conditions and load factors, nothing but high-grade fuel can be satisfactory.

For each plant can be determined the limits of ash, sulphur, and volatile within which coal suitable for use must fall. The next step is buying such a coal most advantageously. It may have been ascertained, for instance, that in a particular plant the load can be carried with a coal having as much as 14 per cent ash, so long as the sulphur does not exceed 2.0 per cent and the heat value is not less than 12,800 B.t.u. The buyer may then advertise for bids or he may put his requirements in the hands of one or more wholesalers with instructions to find the right coal and submit bids.

If some one in the company has sufficient knowledge of coals to select from the bids the best value, which may not be the lowest bid in dollars per ton, the problem is solved. More often, however, this is a task of no mean proportions and many consumers call for car-load samples for test purposes. Coal companies welcome this kind of test, for each knows that if his coal proves the best for that plant, he will secure a good customer.

Careful boiler tests should be made on each kind of coal; the kind of test that tells the value of the coal in terms of steam, figured to delivered cost. For those not equipped to do this sort of work, there are many engineering laboratories that make a business of conducting tests and rendering impartial advice. The more progressive coal selling companies have combustion engineers who not only represent them at such times but who make it their business to see that their customers are getting the most out of the coal furnished.

Getting the best coal for a given plant is not the hardest task. Competent tests by competent engineers can determine this. But a mistake in buying at the wrong time can undo the best work of the technical man. Business judgment of the highest order is called for in buying coal at the right time. In the last five years this country has collectively gone on one coal buying spree after another.

The point is well illuminated by a few notes from history. On April 1, 1916, stocks of bituminous coal in the United States were 50,000,000 net tons, sufficient on the average for five weeks' consumption. Anticipating a strike of coal miners on April 1 that year, consumers had anticipated their needs by about 12,000,000 tons in the first three months of the year. The strike did not materialize and buyers forgot to look at their coal piles until late in the fall, after April 1, having ceased to buy even for current consumption and having drawn on their storage for 23,000,000 tons, or nearly half the total. All during the summer and early fall of 1916 the mines were running on short time because they could get no orders. As a penalty for this short-sighted policy the coal buyers paid heavily. The spot or open market price of soft coal doubled from April to June, 1917, and was only stopped by the action of the coal operators themselves in June, 1917, after we entered the war.

The story was repeated again in 1919 and 1920. With 63,000,000 tons of stocks in their bins on Nov. 11, 1918, consumers ceased the purchase of coal, apparently thinking that what they had would last forever. From that figure they allowed stock piles to diminish by 40,000,000 tons, or to 23,000,000 tons by the first of July, 1920. By the time the miners' strike was settled, stocks in the hands of consumers were down to about 18,000,000 tons.

When the majority go wrong in their judgment, conditions are imposed that the lone individual cannot meet. But it is not always that good judgment in buying coal does not carry its reward in both better coal and cheaper coal. In the early months of 1921, the buyer of coal for industry was called on to decide whether to contract for a year's supply, or buy currently to fill his requirements. Prices on forward delivery were higher by at least a dollar a ton than the spot market. He who elected the spot market is money ahead of him who contracted.

Thus we conclude that getting the most out of the dollars paid for coal means buying the right coal at the right time, and calls for a combination of engineering knowledge and business judgment in a large degree.

Supervising the Power Plant

The Relative Importance of Power Cost Has Increased—Adequate Records Are Necessary in Proper Power Supervision—Where To Look for Waste

By A. D. BLAKE
Managing Editor, *Power*

THE extent to which the item of power enters into the cost of the manufactured product varies with the character of the product, but, in general, it is small compared with that of raw material and labor. When fuel was cheap and business brisk, a reduction in cost of power, relatively speaking, was not such a big factor—often considered as not sufficient to warrant the management's giving more than cursory attention to it. Even in the period following the war when fuel went soaring, just as long as business was good and when the manufacturer received high prices for his product, it mattered little to him if the power cost did rise, as it could be tacked on to the selling price and passed along to the consumer. But with the readjustment of business, the falling off of sales and keener competition, it became necessary to carefully scrutinize every item entering into the cost of manufacture, to discover where possible savings might be effected. It became necessary to do business on a smaller margin of profit and any saving in the power cost became relatively larger.

Raw material in a manufactured article may run from 40 to 50 per cent of the production cost. In the power plant, fuel, which is the raw material, will run from 70 to 80 per cent of the power cost; hence the importance of preventing its waste. Manufacturers, having their own power plants, therefore, were brought to a realization that it is in the boiler room that money can be saved or wasted. In this connection, the boiler plant may be pictured as a produtcion department in which fuel is the raw material and steam the manufactured product.

Adequate Records Necessary

The first step toward better supervision is provision for securing and maintaining adequate operating records; the second, an intelligent use of them. Too elaborate a system is often as bad as none at all and the expense and time consumed in keeping it defeat its real purpose. In some large establishments considerable detail in power plant accounts pertaining to the various services may be warranted, but for the average case it is necessary principally to know at all times the evaporation per pound of fuel, the cost of producing a pound of steam and the cost of producing a horsepower or a kilowatt-hour at the switchboard. This entails the use of scales for weighing the fuel, meters for measuring the feed water, flow meters for measuring the steam supply to various departments where process steam is employed, and electric meters for determining the current supplied to the departments. Labor, fixed charges, maintenance and supplies must, of course, be included, but their cost can readily be obtained from the accounting department. It is also well to keep a card for each piece of power equipment, on which will be noted its date of purchase, cost, repairs, approximate use factor and notes on performance.

Such operating records will show whether or not the performance of the power plant is what might be expected for one of its size and operating conditions. Comparison of records from month to month is also useful when interpreted in the light of load conditions, as indicating improvements or falling off in efficiency; if these governing conditions be neglected, however, the results may be misleading. On the other hand, such comparisons may indicate where a readjustment can be made in the shop load to raise the load factor or permit more economical handling of the power plant units so that each may be operated at its most efficient capacity during as much of the time as possible.

But this is not all. The operating force, if it is to be held responsible for results, must be provided with such instruments as will enable it to detect losses in the boiler plant and engine room. Among such instruments may be mentioned the CO_2 recorder, thermometer, draft gage and steam-engine indicator. Only such instruments and meters as are necessary for determining the cost of power or that will improve the operation of the plant should be procured, and the management should insist, after having purchased them, that they are made full use of. Too often such intsruments are found poked away in dark corners or on dust-laden shelves. The fault in such cases can usually be traced to lack of understanding of their working by the operating force or to failure on the part of the management to insist on their use and to give the records proper attention.

Where to Look for Waste

Prolific sources of waste in the power plant are improper firing methods leading to low CO_2 in the flue gases, too much excess air, boiler settings not in good condition, dirty boilers, steam traps that are not piped back to the hotwell or are out of order, feed water too cold and engines improperly adjusted. Money invested in pipe covering is well spent. In many plants it is possible by slight alteration of the equipment to employ exhaust steam in processes where live steam is now being used. Back of all, however, is the importance of securing the fuel best adapted to the boiler room conditions. This can be determined only after carefully noting the evaporation, the cost of handling ash, furnace repairs, etc., and striking a balance with the price of the fuel.

Establishments whose power plants have been definitely designed to meet present manufacturing requirements will find it comparatively easy to keep a proper check on the operation. Many, however, are not so fortunate. Their business has expanded and necessitated extension of the power plant from time to time, such additions often being made through expediency without regard to the general plan of the original layout. The result is a rather miscellaneous collection of equipment, a complication of piping and inadequate facilities for arriving at operating results. Such a plant affords a splendid opportunity for the engineer to make a showing if he be competent to locate conditions leading to waste and to point out where improvements can be made. However, it is always well for the management to be sufficiently conversant with the possible

sources of waste so that it can intelligently check the efforts and recommendations of the engineer. If the latter requests additional instruments or apparatus or a change in layout he should always be prepared to show that the savings effected will pay a return upon the money invested in the apparatus.

Moreover, should the question arise as to the advisability of changing over to central-station service a complete system of operating records will obviate or combat assumptions and assist the management in arriving at an intelligent decision.

A word in regard to the engineer and the operating force is pertinent. Best results are invariably obtained when the management is prepared to take the engineer into its confidence, to lend an attentive ear to his recommendations and to be prepared to enter into a sympathetic discussion of his problems, at the same time insisting that his propositions be presented in a logical business form and on the basis of dollars saved. Moreover, there should be established among the members of the operating force a feeling of responsibility and a spirit of loyalty to the business. Make them feel that they are an integral part of the manufacturing organization just as are the employees of any other department and not merely tolerated as an adjunct to the establishment. The effort will bring a handsome return.

Proper Maintenance of Electrical Equipment Saves Cost of Shutdown and Repair

Organization of Maintenance Force with Details of Methods Used to Forestall and Locate Trouble and Schedules for Inspections

By E. H. HUBERT
Assistant Editor, *Electrical World*

MANAGEMENTS are coming to realize that it is more economical to forestall trouble in electrical equipment than to suffer the expense of interruptions and repairs. However, in organizing an inspection and maintenance department a proper balance between possible good and the expense of running the system must be obtained. The two organization charts shown herewith illustrate respectively a small, simple system and a large complicated one, both of which have proved successful. An idea of the organization necessary for any plant may be judged by comparison with these two examples. The smaller organization is for a factory with 2,200 hp. in 1,500 motors ranging in size from ½ to 225 hp. These are 220-volt, 60-cycle motors working eight hours per day six days a week.

The larger organization is for a plant working 24 hours a day, except Sunday, and having 500 power motors aggregating 9,000 hp. not including numerous smaller motors for portable tools, desk fans, etc. This is a system described by C. A. Cowdery, electrical engineer of a large New England plant, in ELECTRICAL WORLD. In this system each branch of the organization is in charge of a foreman or leader to whom the men report, and the leader in turn reports to the general foreman on important matters, or for advice.

Duties of Different Inspection and Repair Crews

Motor inspection and repair includes inspecting, repairing, oiling and cleaning all motors and starting apparatus in the main buildings, except the forge shop and exclusive of some synchronous motors which will be dealt with later. Certain men were assigned to inspect the motors in one section of the factory. Whenever a motor was taken down it was thoroughly inspected and cleaned and, if necessary, the coils were varnished and the motor was baked.

In any plant the inspection of motor equipment should include observation of the following points suggested by Sidney Fisher of the Bridgeport Brass Co.: (1) On the motor; oil supply, freedom of oil rings, gaging of air gap, main-drive belt tension, slip-ring surface, speed, frame and bearing temperature; (2) on the control apparatus; condition of make-and-break switches, condition of overload release on compensator, compensator contacts particularly on the running side, inspection of overload relays (timing, damping etc.), oil supply in compensator, temperature of compensator and no-voltage release coil, operation of no-voltage release.

A logical method of procedure to determine the cause of motor breakdown is as follows:

Test Temperature of Motor by Hand

(1) If temperature of frame including bearing is uniform, examine fuses or relays; replace blown fuses and examine relay timing adjustment and damping device.

Start Motor and Stand By

(2) If temperature of bearing is abnormal look in oil chamber. If full of oil examine ring to see if it revolves freely. Reset relays or replace blown fuses. Jerk starting lever and observe motor shaft and chain or belt. If there is no motion the bearing is seized. Put in spare motor.

(3) If temperature of frame is uniform but abnormal, replace blown fuses or reset relays and start motor. Take speed. If speed is less than full-load speed, motor is overloaded. Inquire of floor foreman and look for seized shaft bearing. If either is the cause notify chief electrician immediately. Overheating of a three-phase motor may be caused by running single-phase. Therefore compensator contacts on running side should be examined and repaired if necessary.

The department in the large organization referred to called "general and lighting" was responsible for inspection and maintenance of the entire lighting system. The maintenance of lighting circuits, replacement of lamps, fuses, etc., during the day was carried on by a group of men who also served as helpers to other departments, repairing miscellaneous equipment such as lighting fixtures, extension cords, renewable fuses, sockets, etc. The seven-day men in this group were used on apparatus which required a stand-still inspection on Sunday. This plan of course would not be necessary if such inspection could be done by night shifts.

The night men did no permanent repair work except the replacement of lamps and fuses. One man of each shift stayed at headquarters to answer calls while the other men were on inspection trips, battery charging, changing time recorders and turning on or off stairway, exit and yard lights, as per schedule. If serious trouble developed the qualified day men were sent for. Three seven-day men were responsible for the inspection and maintenance of lighting and power equipment in the

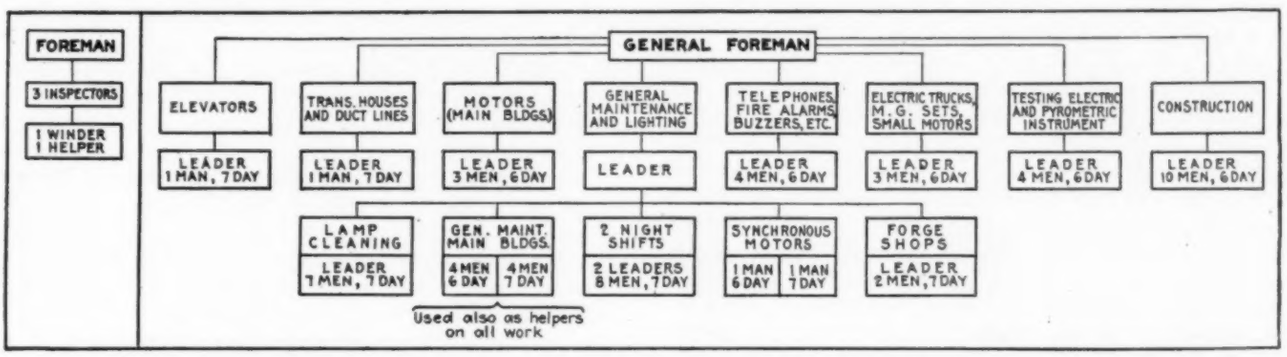
forge shops. The synchronous motors driving exhaust fans required careful inspection as they were installed on the roof and vibrated excessively. These were patrolled during each shift. Between inspections all the men attended to cleaning motor houses, repairs and clerical work.

The lamps were all cleaned on schedule. Those in particularly bad locations, such as those used for certain woodworking operations, were cleaned daily, while those in other places were cleaned every two weeks.

The elevator upkeep was done by one man and an oiler. Cables, contactors, brakes, drums, and hydraulic gates were maintained and pits and cars were kept clean. Written reports were made on most of the parts twice a week and on other parts once a month.

Twenty-one battery-type trucks were inspected and maintained as to batteries, motor controllers and bells, motor-generator sets and charging panels. Numerous small motors such as those used on tabulating machines, adding machines, desk fans and other miscellaneous equipment of this character were regularly inspected, oiled and cleaned. Card records of this apparatus were kept.

Telephones, fire alarms, buzzers, time system, and other low-tension equipment were cared for by five men.



MAINTENANCE ORGANIZATIONS WHICH HAVE PROVED SUCCESSFUL IN TWO WIDELY DIFFERENT PLANTS

Left—A six-man crew for a plant working eight hours per day and having 2,200 hp. in 1,500 motors. Right—A large organization for a plant working twenty-four hours a day and having 500 power motors aggregating 9,000 hp.

The factory had a 300-line automatic set. This crew did installation work which would not be required where a permanent system was already working.

A division made regular inspection of transformer houses and high-tension duct systems. Semi-weekly reports were turned in as to the conditions of houses and apparatus.

Testing is necessary because of variable loads on motors, feeders, etc. Moreover all instruments must be checked periodically. The organization shown also spent much of its time checking pyrometer instruments which are not found in many industrial plants.

The construction crew installed all new apparatus requiring wiring and piping or change of location of any equipment. The organization was especially large because the factory was new and frequent changes were necessary. As the average maintenance man does not qualify as a wireman who can do pipe fitting economically, regular wiremen were employed.

The engineer or general foreman was notified as soon as any trouble occured, such as motor shut-down, overheating of apparatus or any other trouble out of the ordinary, after which he immediately endeavored to find the cause. When trouble was reported a record was made at the office, one copy of which was kept and the other copy given to the proper man for attending to the trouble.

At the maintenance headquarters was kept a record of the location of every piece of apparatus with the nameplate data and other descriptive matter which would help in identification and in ordering new parts.

A card record used in one plant contains the following data for each motor: Number of motor, department, motor driving horsepower, make, type, serial number, revolutions, phases, voltage, diameter of pulley, face of pulley, size of key, diameter of shaft, length of shaft, size of fuses, type of fuses, size and number of brushes. The cards are arranged according to departments. Another set of cards was filed according to the motor number. Some systems include even more complete data, as for instance the kind of coils, the type and size of control apparatus, etc.

Frequency of Inspection

The frequency of inspection varies with the class of apparatus, its use, importance, location and certain constructive features. With the small maintenance system first mentioned the motors, averaging five years old, are inspected twice a week with certain exceptions. Some synchronous machines driving air compressors are inspected only once a week while some important blower motors running at 3,600 r.p.m. are looked at four times daily.

In the large factory mentioned operating 24-hours per day motors in operation are checked daily as to the following conditions: Bearings and frame temperatures, oil level, connections, condition of drive, cleanliness and excessive vibration. Those in dirty places such as forge shops are cleaned by use of compressed air every week, while those in better locations are cleaned once a month. At this time the motor is not operating and the air gap is gaged to determine the condition of the bearings. If low, they are replaced. Once every month the compensators are examined as to condition of contacts, height of oil and loose connections. Overload relays are inspected at this time as to proper setting and proper oil level. On the Monday following this inspection the no-voltage release coils are tested by lifting the relay plunger while holding the handle of the compensator so that it will not shut down the motors. All section circuit breakers are inspected monthly regarding tripping mechanism and condition of contacts. Safety switches are inspected each month. Meters in the powerhouse are tested every four months and less important meters around the plant at longer intervals.

Campaigning for Economy in Tool Consumption

A Scheme that Could Be Followed to Advantage in Many Shops—Education in Care of Tools Aided by Bulletins and Illustrated Posters

BY RAY ANGOVE

ARE the workmen economical in the use of tools? Do they use tools efficiently and carefully, getting maximum production with a minimum of tool breakage? Do they know how to use tools and how to take care of them? Do they return them to the toolcribs or do they keep them lying in the drawers of the workbenches indefinitely? If they do return them, are they returned in good condition?

These and many other questions were discussed at a meeting of the employees welfare committee of a large mid-western electrical industry at its regular monthly meeting, held on Sept. 5, 1921.

When the discussion was opened the majority were of the opinion that little could be done in saving tools; that the workmen in the factory were of a higher than average intelligence, and that it would be nearly impossible to make any improvement along this line.

Bit by bit, however, facts came to light which proved to the satisfaction of the entire committee that the loss occasioned by the misuse and breakage of tools was not a necessary loss and that a substantial saving could be made. Accordingly, it was decided to stage a campaign for the "Better and More Efficient Use of Tools" and a committee was appointed, whose duty it was to spread the gospel and put the campaign across. This committee was cautioned to keep a careful record of all visible results and report to the present committee at intervals. The campaign, it was decided, was to run from the fifteenth of September until the same date in October.

A few words regarding the committee that undertook this work will give a clearer idea of the campaign. The committee was composed of assistant shop foremen, office employees, the director of safety and welfare and the editor of the employees' magazine. The first step of the committee was to come out openly with an announcement of its plans and a statement showing just where and how it hoped to make improvements.

Accordingly the following notice was placed on the bulletin board and while it was intended merely as an announcement of the campaign, created a good deal of interest and accomplished some good.

THE SALVAGE COMMITTEE SAYS YES---

Can the life of the tools we use in the shop be prolonged by proper use and care?

Can we prevent much or any of the breakage of tools?

Can we do better work by using tools properly?

Can we eliminate some of the waste in the use of tools?

The Salvage Committee says yes and will tack up some paper dollars on this bulletin board during the next month to prove it—keep your eyes on the bulletin board.

The writer recalls the following conversation he overheard between an employee and a foreman a few hours after the notice had been placed on the bulletin board:

Employee: "Give me an order for a three-cornered file."

Foreman: "Have you noticed that the committee is trying to make a saving in the use of tools? It has just posted a notice on the bulletin board. We must help it out if we can. We drew several of these files the other day, and I notice that we are drawing them right along. See if you cannot look up some of them and keep them where they will not be mislaid."

The foreman was ready and willing to help and so was the workman, for after looking over the notice, he gathered up, not one three-cornered file that had been mislaid, but six of them, and four were returned to the toolcrib.

The day after the first notice was up, the committee received a letter from the factory superintendent which read as follows:

"Salvage Committee:

"I have heard of the campaign you are conducting for the better and more efficient use of tools.

"Your idea is a good one and your reasoning is sound.

"A saving in the use of small tools will result directly in benefit to every man and woman on the plant payroll.

"One who follows the practice of saving in connection with small tools is certainly a workman to be desired.

"Superintendent."

This letter was immediately put in bulletin form with the heading in bold type, "The Superintendent is with us—Are You?" and pasted on the bulletin board.

On the following day, the employees' magazine, a semi-monthly paper, was distributed. This paper explained fully just what the campaign was expected to accomplish, just how it came to be started and how all the employees could help.

It was at this time that the plant really woke up to the fact that something unusual was going on. Foremen who did not want to be left behind began telephoning to the committee chairman, employees' magazine editor and the superintendent for additional information. The following multigraphed letter was immediately rushed out to every foreman in the plant putting him "in the know" on the campaign.

To All Foremen:

Perhaps you have been wondering what the salvage committee has been trying to get at with its campaign for the "Better and More Efficient Use of Tools."

Briefly, it is going to run several campaigns each of a month's duration, covering nearly every detail of production and shop work. Among these campaigns it expects to hold the following:

For the elimination of fire hazards.

For the elimination of material waste.

For the elimination of accidents, and many other campaigns of like nature.

Perhaps you can suggest some more fields it can cover.

Knowing that every foreman will be glad to help the committee in this work it is going to send you at the beginning of each campaign, a list of suggestions of the ways you can help.

The present campaign for the "Better and More Efficient Use of Tools" will close Oct. 15. Some suggestions as to how you may help to get this idea across are as follows:

(1) Have the men clean up their benches and bench drawers and return the tools they do not need to the toolroom.

(2) See that the men are not using mushroomed tools or tools damaged so they are dangerous.

(3) Talk about the proper use of tools to your men as much as possible.

(4) Put a couple of samples up on your bulletin board showing the tools you use in your department—correctly and incorrectly sharpened, with a few notes on how to care for them. The committee will gladly help you make up this display. The committee thanks you for your interest and hopes you will see the possibilities of its present work and help put it across.

Campaign Brings Results

By noon on the day following the day this letter was sent to the foremen, nearly three thousand dollars worth of tools had been returned to the toolcribs. This was gratifying to the committee, but it was not sure that all the employees were favorable towards the campaign and it decided to make an effort to get everyone helping. The committee agreed that the best way to assure full co-operation was to assume that it was already getting it. This argument resulted in the following notice being placed on the bulletin board:

THANK YOU—

THEY KNEW YOU'D BE WITH THEM

When the members of the Salvage Committee asked all employees to help them in their campaign for The Better and More Efficient Use of Tools, they were confident that everyone would be glad to help.

They are glad to know that their judgment was right.

THEY KNOW YOU ARE WITH THEM BY THE RESULTS OF THE CAMPAIGN

While the campaign is just starting, the wonderful results shown thus far prove that everyone is helping.

Thousands of dollars worth of tools were returned to the toolcribs during the first ten days of the campaign and more are being brought in every day.

They want to thank you and ask you to continue to give them a helping hand until the campaign closes, Oct. 15.

About this time some calls came in for specific information as to what tools were broken? How were they broken and how this breakage could be prevented? To take care of these requests for information, the committee called upon the men in the plant who were most familiar with tools, and from them the desired information was obtained. Pictures were taken of many broken tools, and twenty different posters, of which the following is a sample, were made up and mounted on heavy gray cardboard and sent from one department to another:

One day a member of the Salvage Committee took a stroll to a scrap heap where old tools were thrown and picked out a half dozen to take pictures of.

Take a look at those shown above. Can you imagine how they were broken? Some through carelessness and some through inefficiency.

It cost a good deal of money to replace these tools.

Now do you know why the committee is campaigning for

BETTER AND MORE EFFICIENT USE OF TOOLS?

Will you Help?

It soon became noticeable that the number of broken tools was decreasing rapidly, and the percentage was but a small fraction of what it had been during the month preceding the campaign. The number of tools being drawn from the toolcribs was falling off, and boxes of tools that accumulated in different departments were coming in every day.

While the posters containing the pictures of broken tools made a lasting impression on the majority of the workers, the committee agreed that a display of the tools themselves would be still more interesting. Carrying out this idea, a large cabinet was built with a glass front and about a hundred samples of damaged and misused tools were securely mounted within. Below the glass a paper dollar was pasted together with a short note stating the exact amount of money which had been expended in replacing the damaged tools. This display cabinet made the rounds of the plant, stopping for a day or two in each department.

Foremen in different departments meanwhile had built up little displays of their own and had done much to advance the work of the committee.

When Enough is as Good as a Feast

In every campaign there comes a time when additional work produces but little good and often spoils much of the good work that already has been accomplished, and the committee decided that the saturation point had about been reached.

"What we need," said one member, "is a neighborly, good-humored, confidential poster, which will hurt no one's feelings, but which will help to knit us all together into a happy group, ready to do what we can for the good of each other, and the company." His idea struck a responsive chord with the committee, and his ideas of a "neighborly poster" resolved themselves into the accompanying bulletin. This bulletin was tacked up on the same day the employees' magazine was issued.

LET'S TRY TO BE GOOD NEIGHBORS

When you borrow a lawnmower, hatchet or some other tool from your neighbor, do you return it in good order?

You should at least try.

When you draw a wrench, drill, tap or any other tool from our toolcrib, do you return it in good order?

You should at least try.

Other material regarding the campaign printed in this issue of the employees' magazine consisted of a brief summary of results as far as they had been ascertained up to the time of going to press; a list of "Machine tool DON'TS" compiled by the committee and a word of appreciation from the committee to every employee.

This proved to be a happy conclusion to the campaign. It accomplished the desired result and left everyone with a clean taste in his mouth and no discussion of ulterior motives on the part of the committee was heard. It was quite evident that nearly every employee had realized that the committee was working for the general good of all concerned in trying to lower overhead costs, and they put their shoulders to the wheel and helped in every possible way. A campaign of this sort can be successful only when the motives are clearly established by proper publicity and any campaign which does not enjoy the confidences of all the employees is doomed to failure.

Actual results are always hard to measure but the salvage committee submitted the following items to the parent committee:

(1) There has been a decrease of 75 per cent in the number of small tools drawn from stock.

(2) There has been returned to our toolcribs, nearly $5,000 worth of tools of all sorts which had been lying around in bench drawers and miscellaneous places. With these tools in the cribs it will be unnecessary to re-order in order to keep up a stock of tools, which while depleted in the crib, are lying about the plant not being used.

(3) The number of broken and damaged tools returned for replacement has decreased two-thirds.

(4) Workmen in drawing tools are now very careful to specify the exact tools desired and the kind of material they are to be used on.

(5) Injuries due to the use of mushroomed and damaged tools have very nearly disappeared.

(6) Uses have been found for broken tools that have heretofore been scrapped. As an instance of this, broken hacksaw blades have been found very convenient in performing a certain operation in one department.

In the estimation of the executives of the company, the results are wonderful and they were not slow to appreciate the value of the work carried on by the committee.

The cost of the campaign did not exceed fifty dollars, while the returns ran up into thousands.

Economy in Gaging—And in Gages

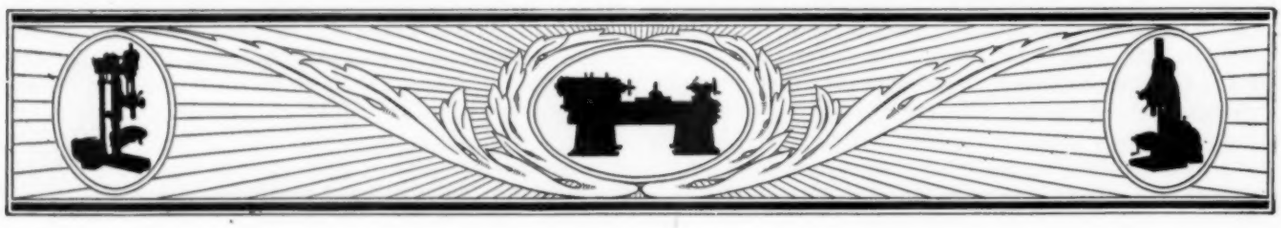
By James Parker

While the economies of manufacture made possible by the use of gages is being increasingly recognized, economy in the purchase and use of gages does not always have the consideration it deserves. The writer visited one plant which required 100 per cent inspection on some parts with tapped holes. The gages were chucked in a reversing speed lathe and the work, held in the operator's hand, was run on and off very rapidly. The gages were discarded after two or three hours' use, by which time they had worn about 0.001 in. It was figured that this paid because of the low labor cost of inspection. But the concern was buying gages made to an accuracy of 0.0001 in. in pitch diameter, and the method, depending upon the judgment of the operator as to the amount of "shake" permitted, held the work to a tolerance of about 0.002 in., which met all requirements.

For another job which required close fits the manufacturer was paying a fancy price for taps selected to 0.0005 in. in pitch diameter and 0.001 in. per inch in lead, and inspecting the holes with thread gages purchased to the same specifications—or lack of specifications. To the manufacturer a thread gage was a thread gage, and its accuracy was assumed as a matter of course. The gage-maker held all thread gages to master-gage tolerances unless otherwise specified. After some discussion the two got together, and for the first job agreed upon a gage-maker's tolerance of +0.00025 to +0.0005 in., at a reduction in price of twenty per cent. The gages lasted 25 per cent longer before discarding, and the sacrifice on component tolerance was not noticeable.

On cylindrical plug and ring gages where the component tolerance is as much as 0.002 in., it is economical practice to allow one-tenth of this on "Go" gages, so placed as to allow for wear, but not on "No Go" gages which get but little wear. A "Go" gage made to exact size wears beyond tolerance almost immediately. A "Go" plug on which the gage-maker takes even a slight minus tolerance is partly worn out before it is first used. The purchaser of gages can usually save money, both in first cost and in maintenance, by specifying tolerances when ordering.

The greatest economy, however, may be realized by correct placing of tolerances on component. Some draftsmen think that 0.001 in. tolerance is enough for anything, and if they give more it suggests sloppy work. There is no greater source of waste in the shop than close limits which are unnecessary. Even when parts require very close fitting, it is usually in one or two points only. Economy requires the widest permissible tolerance on every dimension which requires gaging, followed by strict adherence to them when established. If liberties with given tolerances are permissible, it shows at once that the tolerances should be widened.



The Dollars and Cents Value of Safety

What Industrial Accidents Cost the Employer, the Employee and the Country—Savings Possible Through Proper Guarding—Present Best Time To Install Guards

By JOHN A. DICKINSON
Mechanical Engineer, Bureau of Standards

THESE are overall days, not alone for the employee but for the employer as well. The munition worker's silk shirt has disappeared along with the "Near-oriental" rugs with which the boss was wont to deck his private office; today the worker is wondering when the factory will be put on full time again and the employer is scratching his head, metaphorically at least, over the question of money with which to keep things going until "good times" come again.

Practically every plant in the country is face to face with the problem of lower production costs. Reduction of wages and salaries, the elimination of bonuses, the closer buying of necessary supplies are remedies that have been applied in hundreds of instances. The non-productive departments of most industries have been pared to the bone, or done away with altogether. This, on the face of it, seems logical, but in many instances it will prove to be poor economy. Some of the wiser concerns are increasing their research and engineering departments and are using men and machines, which otherwise would be idle, to develop new products or cheaper methods of manufacturing existing products.

It is unfortunate that safety organizations are generally classified as non-productive, and as such are being sacrificed on the altar of economy. Let us see if the assumption that such organizations are unproductive is correct.

First let us see what accidents are costing industry. There is not a large manufacturing state in the Union where the compensation payments do not *exceed a million dollars a year.* In such states as New York, Pennsylvania, Illinois and Ohio the sum is several times this figure. Dr. L. W. Chaney, of the Bureau of Labor Statistics, gives an estimate of fifty millions as the annual bill for compensation for the entire United States. As a check, the workman's compensation insurance premiums for 1919 were totaled and showed over one hundred millions paid in premiums for workman's compensation insurance. With a loss ratio of fifty per cent this would indicate that Dr. Chaney's estimate is approximately correct for concerns that carry insurance, but is probably low when the large number of concerns which carry their own risk is taken into consideration. For the sake of argument, let us assume that this figure is correct. *Fifty million dollars!* That's a pile of money! Think what that would mean if spent on research for the benefit of industry—imagine the thousands of miles of improved roads that this sum would build and the value to industry of such highways for trucking!

But what becomes of this enormous sum? Does the employer receive any return for it? No, it does not represent one hour of productive work—as far as value received is concerned, it might as well be thrown down the sewer.

To the injured worker it does mean enough to keep body and soul together, but represents less than a third of his potential earning power if he were not disabled. Labor, then, stands to lose not fifty millions but double that sum each year through industrial accidents.

The direct money loss to employer and employee, then, will total not less than one hundred and fifty million dollars but this is not the whole bill; far from it. There are other less obvious losses which in the aggregate are tremendous financial losses. Among these may be mentioned the time lost by other workers in a room or department when a man is injured; the interruption of the factory routine; the cost of investigating, recording and reporting of accidents; the replacement of injured men by less skilled workers with the attendant lower production and higher spoilage; these are a few of the indirect losses which add millions to the total bill.

The Country's Loss From Accidents

Statistics of themselves are stupid things, but properly used they sometimes help in picturing conditions when our ideas are vague and nebulous. The statement that 25,000 men are killed annually by industrial accidents has been made so often that it has lost much of its meaning. If, however, we stop to consider that the average age was 37 with a life expectancy of 30 years, which at an average of $1,000 a year would mean the loss of $30,000 earning power for each man killed, we have here a definite unit of measure. Multiply this sum by the number killed (25,000) and you get a total of $750,000,000, three quarters of a billion dollars lost to the country through its annual death toll from industrial accidents. Add to this a similar sum to indicate the lost earning power of the vast army of totally or partially disabled men turned out by industry each year and you will begin to realize what the effect of industrial accidents is in this country, considered from the financial standpoint alone.

A logical question for the factory executive to ask is how much can this total be cut down if guards are installed? The answer is a difficult one; for years it has been stated, frequently by men who should have known better, that guards will eliminate only 25 per cent of the accidents. From the standpoint of the *number* of accidents occurring in a given plant this may be true, although personally I believe the estimate is low, but a completely guarded plant will eliminate most of the *serious* accidents—those that lay a man up for weeks or months.

To put it another way, it may be true that guards will only reduce the frequency (i.e., the number of accidents per year, per unit number of working hours) 25 per cent, but it will reduce the severity—which is the ratio of disability hours to the number of hours worked—to a much greater extent. If engineering revision in its broader aspect is included under the general heading of safeguarding, the resulting decrease in accident severity and its attendant money loss will be still greater.

Anyone investing money naturally asks what return may be expected. A plant installing new machines

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logically expects the increased production or the reduced costs to pay a fair return on the money invested. Money invested in plant safeguards is frequently considered in the light of a permanent investment and it is but natural that a fair return should be anticipated.

The plant which carries insurance finds that, as a result of the installation of guards their basic manual rate has been reduced a certain amount. At the time the rating schedule was prepared, this reduction was computed so as to repay the assured for the cost of guards in from five to eight years, giving a return of perhaps 15 per cent on the money so invested. While the cost of fabricated guards, or of the material and labor necessary to make them, has increased considerably, the amount saved on insurance premiums through the reduction of rates due to the installation of guards still gives in a majority of cases a fair return on the money invested.

Certain extreme hazards are severely penalized in the schedule, for example, each exposed setscrew adds approximately one dollar to your premium *each year.* Obviously the replacement of such projecting setscrews with safety setscrews will pay for itself several times over the first year and, what is of still greater importance, the reduction of rate due to the elimination of this hazard will continue in effect year after year.

Where large concerns have organized safety departments and have kept accurate record of costs of all expenditures logically charged against such departments, they have invariably found that the saving in accident costs has paid big dividends on the money invested. One of the large steel companies estimates that through the reduction in accidents effected by their safety engineers, they are saving *a million dollars annually over and above the cost of all safety work.* A return of over 100 per cent a year looks like pretty good business. In a recent interview the superintendent of one of the largest high-explosive plants in the world (the du Pont plant at Repauno, N. J.) estimated a saving of 10 per cent over and above the entire cost of the safety department, a return of 110 per cent per year. The examples might be easily multiplied indefinitely.

Besides this direct financial return there is the improvement in the morale of the plant that is bound to follow any honest effort to better conditions under which men work. Safer machines generally mean more production, for the operator can work at the top speed without fear of injury. The installation of punch-press guards in a large plant manufacturing electric flashlights increased production 8 per cent with no increase in the number of machines or operators. The money value of this increased production and the improvement in morale must be added to the already large return on the investment in "safety preferred."

As a business proposition, safety work means just this: that dollar for dollar, money so spent will yield as big, if not a bigger, dividend than any other investment you can make. Safety is not a non-producer; it is a big money maker and will help you cut costs and keep down production overhead.

Now is the logical time to do safety work; skilled men are available, materials used in the construction of guards have been reduced in price, and the machines to be guarded can be spared more easily now than they can in times of full production and, best of all, the reduction of accidents will help curtail the overhead expense.

Using Conveyor Belts to Speed Up Service in the Lunchroom

BY SIDNEY M. CROSSET

One of the big features of any industrial lunchroom is low price. Generally speaking, employees expect that in any proposition of this kind conducted by the company the prices charged will be lower than elsewhere. The reason for this is that an industrial organization ordinarily does not conduct such a commissary for profit. And it is highly desirable to watch closely the costs in the industrial kitchen and dining room, in order that expenses may be kept down.

In our dining hall, here at the Bausch & Lomb Optical Co. plant, we have at least two things that seem to help in our service and in eliminating useless expense. One of them is a device that speeds up the service in the dining hall and keeps the lines of patrons moving without interruption at a regular speed. Belts were placed along the outside of the four counters. Each belt is stretched from one end of its counter to the other. While lunch is being served the belts are put into motion by small electric motors and kept moving at about the speed of a loitering walk. The upper part of each belt travels over a long shelf about waist high and about 15 in. wide. As the dining hall patron picks his knife, fork and spoon from the trays at the entrance end of the counter he places them on a tray selected from a convenient rack. He then places the tray upon the moving belt.

As he passes along the counter he must either travel with the tray or hold the tray back with one hand. The tendency is very strong to move with the tray and to speed up his selection, materially aiding in giving those behind him quicker service. This enables us to serve a great many people in a brief period of time, and therefore permits the chef to dismiss his extra noon help within 15 or 20 minutes after the service begins. The speeding up is confined to selection and does not extend to eating.

The entering ends of the four counters are to the outside. The lines move toward the center of the hall, and as the patrons leave the counter in the center, they can very easily select tables in that vicinity or at either end of the room. An iron rail about waist high along each counter makes it necessary for all patrons to pass the entire length of the counter, entering at a certain place and leaving at a certain place, permitting proper collecting for the food. As the patron reaches the counter at the entering end the regular 25c. lunch ticket is taken. If he does not have the 25c. lunch ticket he may not enter the regular dinner counter line, but is in that case directed to the a la carte counter. After the 25c. lunch ticket is taken, the patron makes his selection and as he leaves the counter at the center of the hall the checker collects for any extra dishes. All payments are made by checks purchased before the patron enters the line, a feature that eliminates delays that would be caused by making change.

Another point that saves time and eliminates superfluous help during the lunch hour is the layout of our serving counters. In our dining hall, all dishes are kept under the counter in steam heated tables and everything is within very easy reach of those dishing up the food. The chefs do not have to leave their posts or even turn around. None of the heated food has to be dished up very far ahead of time in order to present an adequate supply.

Oil Conservation and Better Lubrication

Getting the Greatest Service Out of Lubricating Oils—Necessity of Selecting Oils According to Service Desired—Economies of Reclamation

By R. E. LANGSTON*

NO INDUSTRIAL plant is so small that it can afford to neglect any part of its costs, and in these days special care should be given to the costs of lubrication. Included in this cost must be considered not only the actual cost of the oils, but also the cost of extra power necessary to overcome the friction loss, the labor of the oilers, and the wear and tear on the machinery which can be traced to faulty lubrication.

Almost every employer uses some method to note whether or not his workmen are putting in a full day. It is just as important to the user of industrial machinery to know whether the lubricating oils he is using are giving him their full value, or putting in their full effectiveness, as it is to know whether an employee is careless and wasteful or whether he is alert and capable.

Competition in modern industry demands a greater reduction in the cost of manufacturing power. One of the biggest factors entering into the reduction of power costs is the further elimination of friction by scientific lubrication. Means for reducing the frictional resistance in all machinery and moving parts has been the study of engineers for a long time. The elimination of long, heavy transmission shafting; the adoption of individual drives for machines; the ever increasing size of power units; the very extensive use of ball and roller bearings; the demand for better oil and its use in stream feed and force feed lubrication; all point to this effort.

Frictional loss can be reduced to a minimum only by the most liberal use of the correct grade of good oil. The oil bath or flood lubrication represents the most perfect lubrication possible, as well as the limit beyond which friction can be reduced by lubrication. Stream feeding by gravity or force feeding of oil is the best example of flood lubrication, while scanty, insufficient lubrication is represented by all hand or drop feeding of oil.

With the ever increasing cost of oil to be met, stream feeding of oil to engine and machine bearings would be almost entirely out of the question if it were not possible to collect this used oil, thoroughly cleanse and purify it, and return it to its original state, using it over again many times. Lubricating oil does not wear out. It becomes foul with impurities which must be removed. The lighter volatile elements in its make-up often evaporate due to its contact with the heat of the bearings, but otherwise its composition is not changed. It is a most extravagant idea to believe that bearing oil is consumed or destroyed through use.

Executives are requiring that a closer account be kept of the cost of oil expenditures, and that every possible means be resorted to for its most efficient use without that prohibitive expense. The following suggestions will be of special interest to all owners and operators of industrial machinery and if put into practice will return large earnings in proportion to the investment:

In the first place, there is a proper oil for every duty. Be sure that you are using the oil best suited to your particular requirements. Commercial lubricating oil, as it is manufactured today and sold under different brands, is the product of a long series of complicated operations and treatments. Every grade of every brand is manufactured to possess certain physical qualities. Distinctive characteristics are purposely placed in each grade in order that it may be especially adapted to perform a particular duty.

Selection

Next, the selection of a proper oil for a specific duty should be made by a lubrication engineer, who is not only familiar with every operating condition under which the oil will have to work, but with the specifications and qualities of the different oils as well. Let him make a survey of the plant and its requirements and co-operate with the chief engineer in making his tests. Be governed by their decision alone and not that of your purchasing agent when you select your oil. Great care should be taken in making this selection. The price of the oil should never enter into the consideration of its fitness for the best of service. It is not cheaper oil you need, it is cheap lubrication.

In changing from a machine oil priced at 32 cents per gallon to a 39 cent machine oil, properly selected for the particular set of conditions found in its machines, one very well known manufacturing concern is reducing its oil expense 36 per cent.

Oils are subject to vaporization, and when storage facilities are provided care should be used to locate them where vaporization and deterioration will be the least. It is always advisable to distribute oil from a central station, oil room or distribution point, with a responsible man in charge to keep a strict record of receipts and to accurately credit each delivery. Sloppy methods of storing and handling subjects the oil to too much unnecessary waste. Provide fireproof steel tanks for your oil house storage, with a correct measure delivery pump on each tank. Self-measuring pumps for your oil house are the same as cash registers for the merchant—they are time savers, waste eliminators and are reliable automatic accountants. Modern oil storage and dispensing apparatus are among the most valuable equipment used in any industrial plant. It prevents those small leaks in profit and losses in time and labor, which in the aggregate amount to many times its original cost.

Ample Lubrication

See that all oils are delivered to the surfaces requiring lubrication. The effectiveness of an oil in reducing friction depends as much upon the manner in which it is applied as upon its quality. To obtain the best results there must be an abundant supply of the lubricant. With a circulating oiling system to feed the oil to the bearing, oil of lower viscosity can be used on account of the increased amount of oil reaching the bearing and compensating for the oil that has been squeezed out. This flood of oil tends to reduce the temperature of the

*Lubrication Engineer, with Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

oil film and keeps the bearing cool. The working temperature is lower and the working viscosity is higher than where less oil is fed. Too much emphasis cannot be given to the importance of ample lubrication, such as afforded by flooded bearings, and by bath lubrication, because of the great reduction obtained in friction losses through the free use of an oil of proper viscosity.

Oil Reclamation

Provide arrangements for collecting and recovering every drop of your used oil. It is correct to say that a mineral lubricant never wears out, and that if it were possible to protect the oil from the invasion of foreign particles—dust matter, sediment, water, etc.—and to prevent slow evaporation at running temperatures, a given quantity of oil might furnish perpetual lubrication. While it is almost impossible to prevent foreign impurities from getting into the oil and contaminating it enough to make it unfit as a correct lubricant after it has once been used, it is possible to circulate that oil through a filter that will remove all of that dust matter, dirt, water and sediment and make the oil just as good as new.

A first-class oil filter, regardless of its size, whether it be used to purify a continuous stream or whether it be used to reclaim the oil from the drip pans, engine beds, sumps, etc., is an almost indispensable piece of engine room equipment. Good oil costs too much to be thrown away. Purchase a small portable filter in which to pour all of your hand-caught oil drips—one which will deliver a continuous supply of pure, clean, reclaimed oil. As an auxiliary source of oil supply an efficient portable filter is indispensable in an engine room. It will pay for itself in about three months time in the saving of oil alone. The up-to-date oil filter is the greatest exponent of modern oil conservation.

Filtration Systems

Arrange your engines or machines for stream feed lubrication. Install a properly designed oil circulation and filtration system to serve each individual engine or group of engines or machines. In a circulation system delivering flood or force feed lubrication to bearings we have the ideal method of providing perfect lubrication. If we add to this system an oil filter that will keep every drop of oil pure, clean and cool, we have a combination that will produce this perfect lubrication at a cost that is inappreciable. The correct oil for your special requirements may be had in an unlimited supply regardless of its cost per gallon. Buy the correct oil at any price. Supply to every bearing all the oil it will take. There will be no waste, for the filtration and circulation system permits no loss by leakage or spillage and makes it possible for you to use your oil almost an infinite number of times.

In a prominent industrial power plant generating 1,500 kw. electrical power the installation of an automatic oiling and filtering system, supplying lubrication of vertical engines, reduced the monthly oil requirements from 650 to 25 gallons, which represented savings of $187.50. It saved the labor of one oiler at $115 per month, and increased the power output nearly 1 per cent. The actual total saving in labor, oil and coal was $367 per month, or more than $4,400 per year. The oiling and filtering system to accomplish the economies in expenses and conservation of valuable oil cost in the neighborhood of $1,500 completely installed. This is a typical example of better lubrication combined with oil conservation.

Improved arrangements for the storage and handling of oils will eliminate much of the expense charged to plant maintenance. Better lubrication will have a very large influence on operating costs. It is a long step in the direction of increased engine room economy. The seizing of one bearing, or the shut-down of one machine, with its accompanying loss of service, represents a great deal more than the difference between the cost of poor, unreliable systems of hand feeding of oil and a dependable system delivering correct lubrication. It represents the most economical production of power, uninterrupted service, reduction of maintenance costs, the elimination of waste, and clean, efficient engine rooms, all of which are essential to meet keen competition.

Oil conservation not only means the prevention of unnecessary leaks and losses in the storing and handling of oil, but it means better lubrication or a more effective use of these valuable lubricants through a scientific knowledge of their correct application.

Where the Suggestion Plan Pays

Suggestion contests are given credit by the Franklin Motor Car Co. for bringing out many valuable ideas. The suggestors are divided into three classes—workmen, foremen and salaried staff employees.

Any hourly workman is entitled to submit to the suggestion department suggestions along the line of improving the quality of the product, improving the quality of work, decreasing the cost of production without lowering the quality, eliminating unnecessary work, better plans for shop work, cutting the cost of tools and operations, better plans for office work, etc.

The prizes for this group are: First prize, $400; second, $300; third, $200; fourth, $100; fifth, $50; sixth, $50; seventh, $50; eighth, $50; ninth, $25; tenth, $25; eleventh, $25; twelfth, $25; twenty-five prizes of $10 each. Three dollars will be given for any adopted suggestion not winning a prize.

Suggestions from foremen and master workmen will not be adopted which might ordinarily be interpreted to come within the scope of a foreman's or master workman's regular line of duty.

The second group prizes are: First prize, $400; second, $200; third, $100; fourth, $50; fifth, $50; sixth, $25; seventh, $25. Three dollars will be given for any adopted suggestion not winning a prize.

All salaried staff employees in any department, except major department heads and assistant department heads, are eligible to participate under Group III. In this group suggestions will not be considered which might be interpreted as coming within a man's regular line of duty through special assignment or otherwise. There will be no reward given in this group as in the others for adopted suggestions which do not win one of the three prizes.

These prizes are: First prize, $400; second, $200; third, $100.

The substantial awards for prizes bring out the best ideas and make the men feel that they are well worth while. So far the system is new, but judging from the success it has been, and the money it has saved the company, it will be continued. The prizes are awarded every six months at present, the last award totaling over three thousand dollars. If found desirable, future contests will be held quarterly.

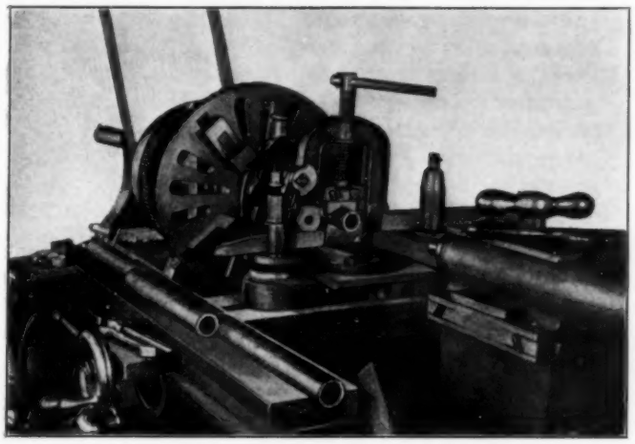
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Threading Pipe in the Lathe

By Tommy Weeks

When the boss goes away and leaves a fellow all alone to thread up a stack of short lengths of pipe by hand, the job soon becomes very tiresome and monotonous, even if the pipes *are* only 1 in. in size; larger sizes would be proportionately worse.



THREADING PIPE ON THE LATHE

Being in this fix one day I conceived the idea that led to the development shown in the picture, a device doubtless well enough known to other fellows who have been longer in the business, but which I invented on the spur of the moment. I bolted a portable pipe vise on the cross-side of an old lathe and, after unscrewing the handles from the die stock, carefully centered up the latter in the chuck.

This being done, all that remained was to let the engine do the work while I bossed the job and directed an occasional squirt of oil into the die at proper intervals.

When the boss goes away again under similar circumstances I am going to take the tailstock off the lathe; then I can thread long lengths too, by letting the pipe hang out of the window.

Making a Tap from an Old Screw

By Gus Haessler

During the late war we had a small bench milling machine in our shop, which from almost constant use, day and night, had one of its feed screws and nut so badly worn that the machine was put out of commission.

Local conditions were not favorable for replacements and the manufacturer was requested to supply these parts, but he was able to furnish the feed screw only. While waiting for delivery of the latter the screw was examined and found to be worn mostly in the middle, and gradually less as it approached the shoulder end of the screw. A few threads adjacent to the shoulder were not worn any, while a few more beyond were but slightly so.

The screw was ½ in. in diameter with a 10-pitch square thread. It seemed possible with a little machining to form a tap out of the worn screw, so it was cut off at a favorable point and finished to pass through the hole in a new bronze nut which was prepared. The flutes and relief were filed.

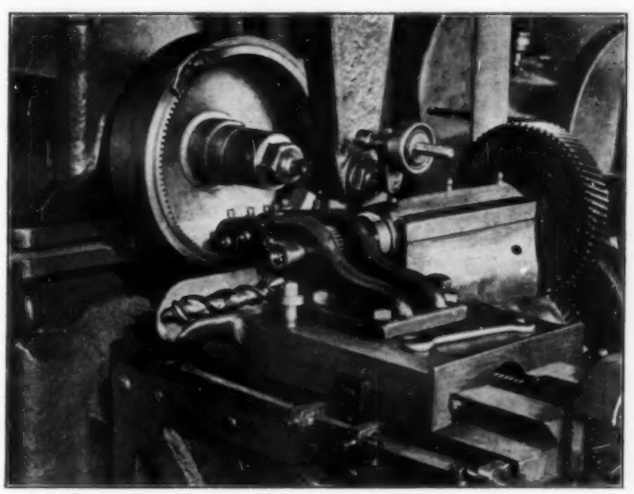
After tempering the tap we started in to face the music both of the skeptics and the tap; nevertheless the tap made the trip through the nut, making a job which the new screw, upon arrival, showed to be practically perfect.

Home-Made Internal Gear Cutting Fixture

By Milton Wright

Having a number of internal gears to cut, and having nothing in the shop with which to cut them except an old Brainard automatic which would cut spur gears very nicely but would not handle the internal ones, we made the attachment shown in the accompanying illustration.

We were fortunate in having sufficient room between the web of the gears and the ring upon which the teeth were to be cut to clear the attachment, but as the latter does not project beyond the cutter, it will easily take cars of any internal gear that can be cut with a rotary cutter.



ATTACHMENT TO BRAINARD AUTOMATIC GEAR CUTTING MACHINE TO CUT INTERNAL GEARS

The casting which forms the housing of the device bolts to the cross-slide of the Brainard with the first pair of holes in the webs in line with the cutter spindle, so that all that is necessary is to put in an arbor with a spur gear of the proper size upon it instead of a cutter. Two other pairs of holes accommodate plugs upon

which the intermediate gears revolve, the plugs being held against endwise movement by setscrews, while a fourth pair of holes provide bearings for the actual cutter arbor upon which the cutter and the final gear of the train are keyed together.

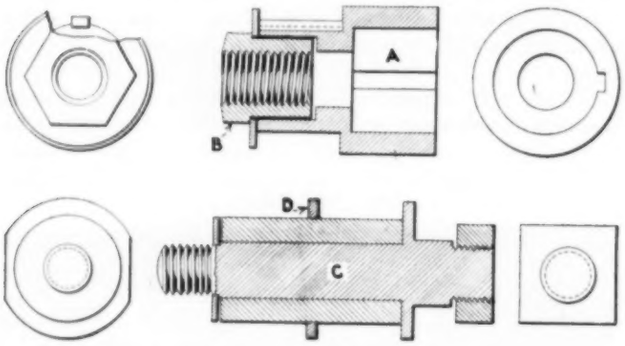
The indexing and feeding mechanisms of the machine were not disturbed or disarranged in any manner, and it is therefore possible by selecting the right cutter and intermediate gears to cut any internal gear within the range of the machine as readily as a corresponding size of external gear would be cut.

Extending Lead Screw of Lathe To Use Compound Gearing

BY MARTIN H. BALL

It sometimes happens that to compound the change gears on a plain lathe—that is a lathe without quick-change gear equipment—would be an advantage to obtain a desired feed, or a necessity in order to cut a certain thread. Such a need prompted the design of the lead screw extension shown in the illustration, for use on a 48- and 26-in. McCabe double-spindle lathe. The scheme can be applied to any lathe with plain change gears, making the dimensions to meet the requirements.

The parts required are an extension sleeve *A* and a special nut *B*. This nut serves the double purpose of binding the extension to the lead screw and of holding the change gear in place, thus holding the three members



EXTENSION FOR LEAD SCREW

firmly together. A stud with loose bushings, as shown at *C*, is also required for the intermediate gears.

The spacing collar *D* is made of the same width as the thickness of the wall between the shoulder at the base of the thread on end of lead screw and the shoulder on the extension against which the gear hub seats.

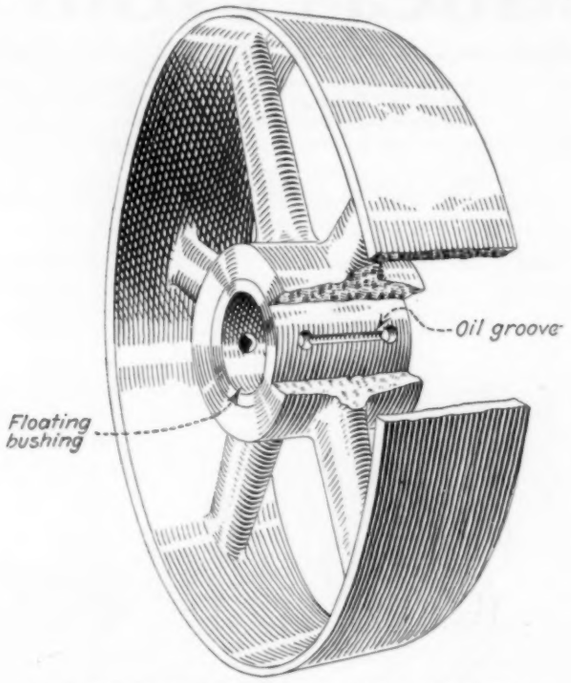
Abating the Nuisance of the Loose Pulley

BY F. W. COLEMAN

I have read with interest the numerous schemes published in the *American Machinist* for doing away with the annoyance of loose pulleys that become *too* loose, and am inspired to submit a method by which I overcame the difficulty.

As shown in the sketch, I made a bushing of good clean cast iron that was bored to a running fit on the shaft and likewise turned to a similar fit in the bore of the pulley, so that it acted as a floating bushing. With suitable oil holes and grooves in the bushings, pulleys fitted in this manner have run for several years without causing trouble.

In some places we had conveyor or transfer chains running under special furnaces for removing clinkers, and these chains ran over 8-in. flanged wheels. Owing



FLOATING BUSHINGS FOR LOOSE PULLEYS

to the heat to which the parts were subjected, oil would not remain in the bearings of the pulleys. Fitting the latter with these floating bushings removed a great deal of the trouble.

Special Tools for a Drilling and Tapping Machine

BY H. E. JEWETT

The writer is connected with a company whose product consists mainly of optical machinery, the parts of which require the drilling and tapping of many small holes.

Up to about a year ago all of this drilling and tapping had been done, one hole at a time, mostly upon four-spindle gang drilling machines, but at that time the company installed a twenty-four spindle automatic

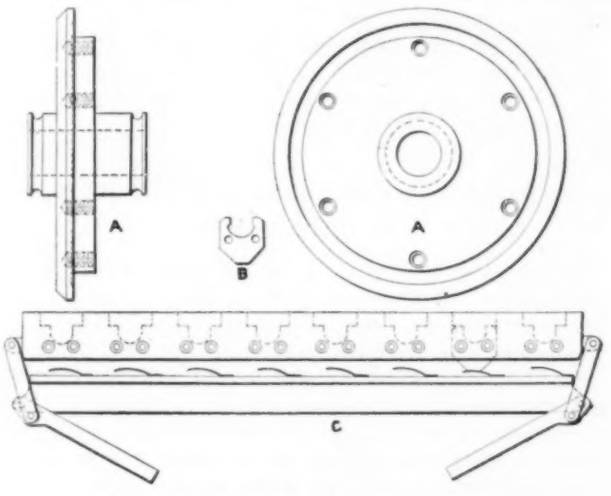
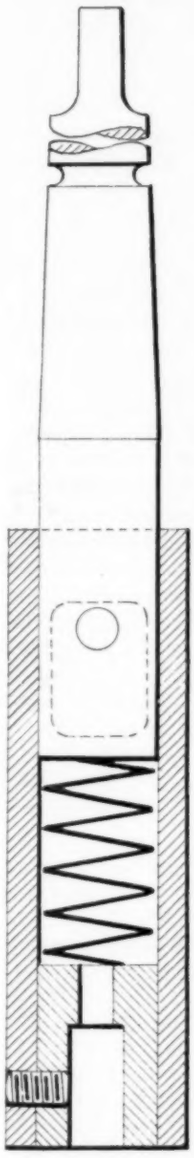


FIG. 2. EXAMPLES OF THE WORK

drilling and tapping machine the spindles of which were adjustable for center distances.

The minimum distance in this respect was ¾ in., but we could not find on the market a tap holder that was less than 1⅜ in. in diameter. We therefore designed the holder shown in Fig. 1. It permitted us to use the minimum adjustment provided by the machine and at the same time enabled us to use taps as small as 10-30 without serious loss from breakage.



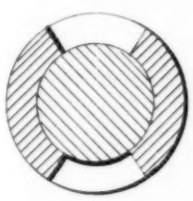


FIG. 1 THE TAP HOLDER

This holder consists of a sleeve driven by a floating connection from the shank and having a bushing with a hole part way through to fit the body of the tap and a square hole for the remainder of the distance to do the driving. A setscrew passing through both sleeve and bushing served to hold the tap in place and a coil spring above the bushing compensated for any variation in lead.

With this holder we were able to use taps of different diameters at the same time, a thing which the makers of the machine believed to be impossible. On one job we are using eight $\frac{5}{16}$-in. taps and four ¼-in. taps at a single thrust. We then turn the piece one-quarter way over and tap four ⅜-in. holes before removing it from the jig.

The agent for the machine told us that in order to drill at one end of the table and tap at the other we would have to place the jig on a block of sufficient thickness to prevent the reverse on the tapping attachment from striking the trip while drilling. To overcome this difficulty we removed the setscrew that secures the tapping attachment to the head and substituted a pin which is controlled by a lever and spring; enabling the operator to disengage the tapping attachment while drilling, and when the head is raised it automatically snaps in again.

We are now able to drill two pieces, like that shown at *A* in Fig. 2, having six blind holes in each, and, after drilling to remove the bushing plate, move the jig to the other end of the table and tap them. The old time with a single spindle was from six to seven minutes each; the new time is less than one minute each.

We make a great many pulleys 5 and 5½ in. in diameter, and for these we have a jig that holds four pulleys. The operator recently drilled and tapped 200 of these pulleys in 3 hr. and 54 min., including the set-up time, and we believe this time can be materially reduced.

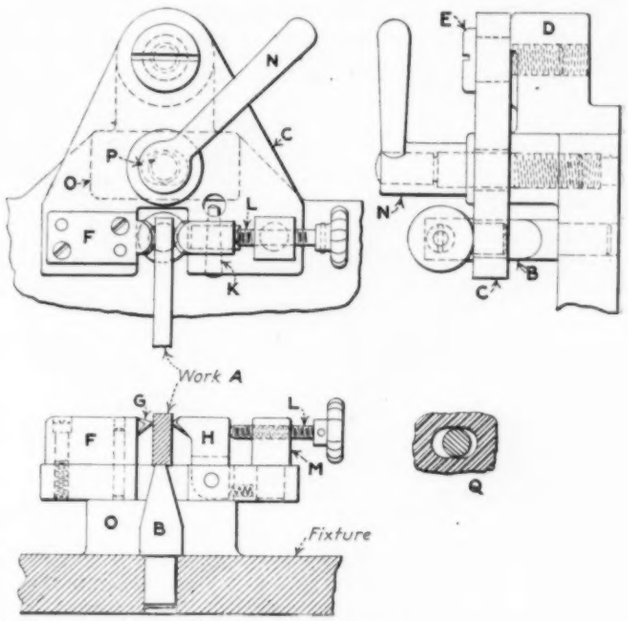
For drilling and tapping the piece shown at *B*, in Fig. 2, we have a jig which is bolted to the table, having locating plates beneath the bushing plate as shown at *C*. Eight pieces are held in this jig by springs attached to a bar, which is controlled and locked in place by two levers. No more time is consumed in loading this jig than was required to secure one piece in the old jig and the saving is more than 90 per cent after the job is set up. A very similar device is used for drilling ¼-in. holes near the end of pieces of ½-in. cold rolled rod, fourteen pieces being drilled at once. So far as possible we build our jigs to standard set-ups with 1⅜-, 1⅝-, 2-, 3- or 6-in. centers. This method frequently allows us to use the same set-up for several jobs.

A Floating Clamp

BY GENE PHELPS

A floating clamp is often needed in fixtures for work that is permanently located on one end and having a projecting member requiring rigid vertical support with a variation in sidewise location.

The illustration shows a design for a floating clamp with knife edge contact that can be adapted to many varieties of work. The end of the work *A*, which requires clamping, rests on the stud *B* pressed into the fixture body as shown. The floating member of the clamp *C* is fastened on the projecting boss *D* by means of a shoulder screw *E*, made so as to allow the clamp to swing free. The block *F* has a knife edge *G* and is held firmly on the clamp on one side of the opening shown. On the other side a block *H* is fitted in a slot and pivoted on the pin *K*. The screw *L*, attached to *M*, strikes the block *H* which in turn clamps the work securely and holds it down on the locating stud. It is evident that the clamp has now aligned itself to the position of the work and it is ready to be located by the binder screw N which clamps directly over the supporting pad *O*. This pad supports the clamp and also avoids any springing action when the binder pressure is applied. The amount of float required can be governed by the elongated slot *P*, shown in detail at *Q*.



A FLOATING CLAMP

This design of clamp can be changed in various ways, such as using a button in place of the block F, and having a screw with a swivel come directly against the

work. A spring plunger can be used in place of the stud *B* providing the work is of such a nature that a vertical adjustment is necessary.

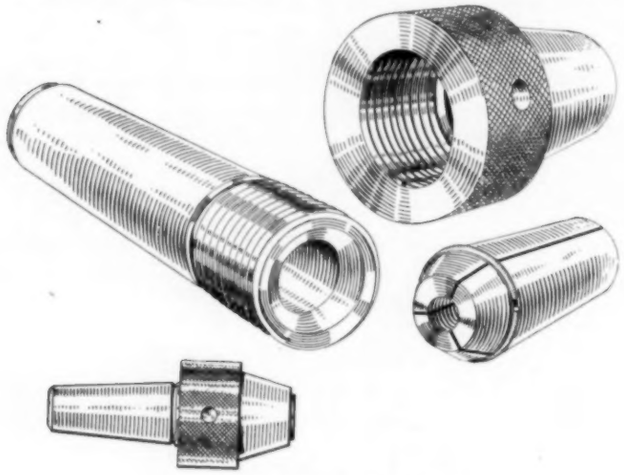
Collet Chuck for Lathe

By Fred S. Harger

The illustration shows a collet chuck that the writer made to use in lathes that had no draw-in attachment. It should be made of tool steel, hardened and ground, but the one I have is made of ordinary machine steel, left in its natural condition of hardness (or softness), and it has given me good service for the last four years.

The taper shank is first fitted to the lathe in which it is to be used and all subsequent operations upon this part should be performed while in place. The thread should be of a rather fine pitch (mine is 12 pitch, 2 in. diameter) in proportion to the diameter in order to give good gripping power.

The collets should have an abrupt taper or beveled end where they bear against the corresponding part of the shank, as this assists in bringing all parts into alignment when the chuck is closed. My collets are split in three pieces after finishing to size and shape, and are held together by a ring of spring wire snapped



COLLET CHUCK FOR LATHE

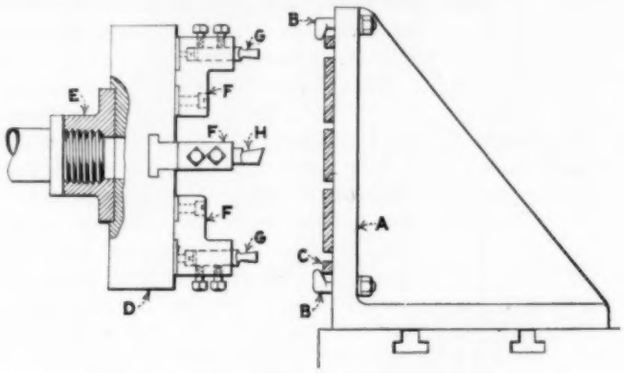
into a groove turned at the point of largest diameter. This ring is not absolutely essential but it is mighty convenient in keeping parts of a size together when out of the chuck.

The taper of the outer end of the collets and the corresponding taper bore of the shell should not be too sharp or it will cause trouble in releasing. Mine has a taper of $\frac{1}{16}$ in. in 2 in., which is the length of this part. Care should be exercised at this point, as upon the accuracy of this fit the working qualities of the chuck in a large measure depend.

A Trepanning Tool for Boiler Plate

By Alex Dowel

The trepanning tool illustrated on page 357, Vol. 55, of the *American Machinist* reminds me of one that I built some years ago for very much the same sort of work. We had to make from 50 to 100 collars of each size ranging from 4 to 8½ in. o. d. Each collar had a hole in it and the holes ranged in size from 2 to 5 in.; the thickness varied from $\frac{3}{16}$ to $\frac{1}{2}$ in. There were about a dozen different diameters yet not more than 100 of any one size and only 50 of most sizes. I rigged up an angle plate as shown in the sketch at *A*, and set it up on an old boring mill at right-angles to the spindle. I slotted the plate vertically so that I could use hook bolts *B* to hold the boiler plate *C* firmly. A 12-in., 4-jaw independent chuck *D* was obtained and fitted with an adapter *E* which was bored out and threaded to suit the



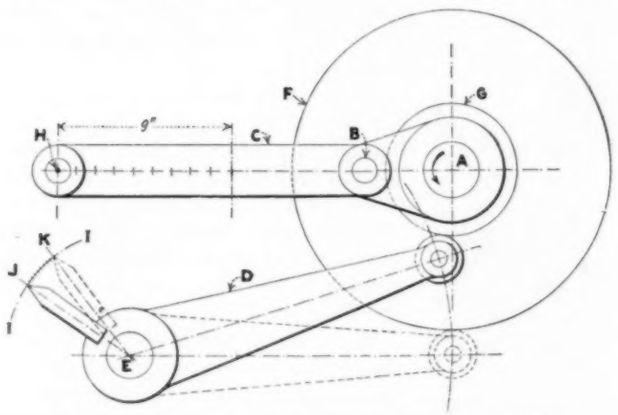
TREPANNING TOOL FOR BOILER PLATE

spindle of the boring mill. Four special jaws *F* were made and screwed to the sub-jaws of the chuck as shown. Grooving or parting tools *G* were set in the two outside jaws so that they could be adjusted easily by means of setscrews. Tools *H* were fitted to two other jaws for boring the inside hole. In cutting out any given size of washer the tools were set progressively, the first tool removing the stock nearest the center, the second finishing the hole and the third and fourth cutting and truing the outside diameter. This tool worked very well and as far as I know is still in use on the same kind of work.

Practical Method of Laying Out a Cam

By M. H. Snow

In the accompanying diagram *A* is a shaft, driven at a constant speed, on which is a crank *B* moving an object by means of the connecting rod *C*. A lever *D* is swung from the center *E* carrying a suitable roller in contact with a cam, the outside diameter of which



GRAPHICAL METHOD OF LAYING OUT A CAM MOVEMENT

is the circle *F*, the base diameter being represented by the circle *G*. The shaft *E* is to be oscillated in exact harmony with the speed of the object that is moved by the crank and connection first mentioned.

The procedure of laying out the cam was as follows:

A cardboard disk was cut to the outside diameter of the cam and, at the crank distance from the center, the connecting rod (also made of cardboard) was pivoted. At the point *H* a small hole was punched. On the center line was laid off the distance the object was to be moved (in this case 9 in.) and divided into a number of equal spaces. Now a cam arm and roller were made from cardboard and pivoted at the center of shaft *E*. (It is understood that all this procedure was carried forward on a drawing board, with thumbtacks for centers.)

Now a piece of cardboard of a convenient length was made with a pointed end and fastened to the hub of the arm *D*. At the point of this card the radius *I* was scribed. The cam roller was then placed in contact with the line representing the base of the cam and a mark made at the point *J*. The same thing was done with the roller on the outside of the cam and a corresponding mark made at *K*. The space thus marked off on radius *I* was divided into the same number of spaces as were previously made upon the center line.

The cam disk was moved around until the hole *H* coincided with the first division on the center line. The arm *D* was moved until the pointer lined up with the first division of the radius *I*. With a sharp pencil a line was then scribed around the cam roller. This operation was repeated for each division until the crank had made one-half revolution when the procedure was reversed.

The cam thus formed is practically correct. The larger the number of divisions, the more accurate it will be. This method can be applied to many different constructions.

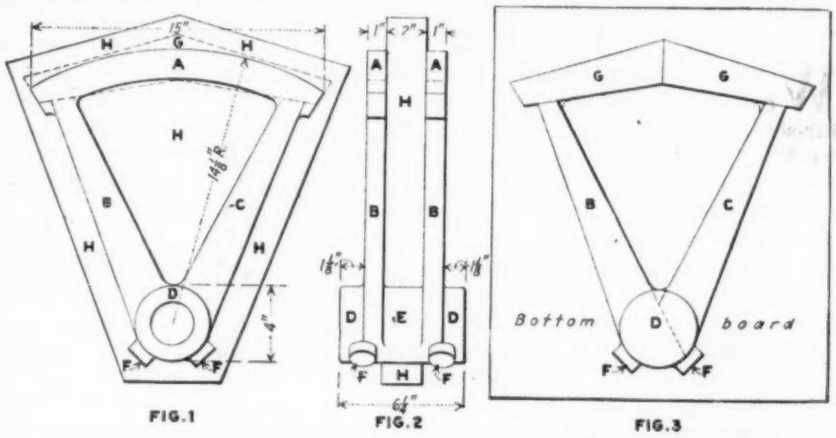


FIG. 1. PLAN OF PATTERN. FIG. 2. EDGE VIEW OF PATTERN. FIG. 3. ASSEMBLED PARTS OF FIRST PATTERN ON BOTTOM BOARD, READY FOR THE "MOLDING" IN DRY SAND

A "Pattern" Made of Core Sand

BY M. E. DUGGAN

A broken casting in a special machine required immediate replacement. It was a long way to where the machine was built, and to obtain a duplicate casting from the original pattern would have taken a prohibitive length of time, even if the pattern were in existence.

The facilities of the "home town" comprised a small jobbing foundry and a machine shop, but no pattern-making establishment—not even a man who was a good whittler. The job was put up to the old foundryman who, after giving the broken part the "once over" said: "I can produce a casting that will answer every requirement without the necessity of making a special pattern of wood, provided you are not too particular about exact duplication." Here is the way he did it:

The casting was a double sector, or "A-frame" as it was called, with a connecting hub 4 in. in diameter. The "pattern" was made entirely of core sand, as shown in Figs. 1 and 2. *A*, *B*, *C*, *D*, *E*, *F* and *G* represent the various parts of the pattern, while the letter *H* indicates the piece that was first a part of the pattern and afterward the separating core between the two sectors in the mold.

The education of the old foundryman in matters geometrical had been sadly neglected and he was at a loss for means to produce the curved portions of the sectors, so he compromised by making them up of straight pieces as indicated at *G*; the outer surface of the casting being afterwards turned to the required radius in the machine shop, while the inner contour was allowed to remain as he left it.

Parts *B*, *C* and *G* were then cut from slab cores 2 in. thick by means of a hack saw blade and finished up with a coarse file. The hubs *D* and the bosses *F* were made from stock round cores.

Assembling the parts on a bottom board, as shown in Fig. 3, a light frame, or temporary flask, was tacked together around them and a mold made of core sand, which was then baked in the usual manner. Returning this "mold" to the core-maker's bench, two "patterns" were made from it that were to constitute the *real* pattern from which the casting was to be molded.

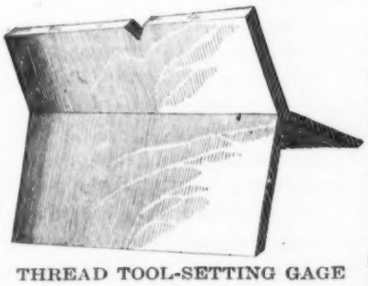
A slab core 2 in. thick, indicated by the letter *H*, was now made with a 4-in. hole through it where the connecting hub is shown in Fig. 2. The two patterns were temporarily fastened to this slab with the hubs in alignment with the 4-in. hole. The bosses *F* were "slip pieces" attached to the main pattern in the usual way so that they would be left in the mold when the pattern was drawn, and afterward fished out when the pattern was out of the way.

The completed pattern as shown in Fig. 2 was then rammed up in the regular flasks and, after being drawn, the sectors were removed and the part *H* replaced in the mold where it became the separating core; the 4-in. hole serving to form the connecting hub.

A Useful Thread Tool-Setting Gage

BY E. LYTTON-BROOKS

London, England



THREAD TOOL-SETTING GAGE

The accompanying sketch shows a useful center gage for setting outside threading tools. Unlike many on the market, it has the advantage of being easily held in position on round stock without slipping off. I have not yet seen one of this type manufactured or in use. The V-grooves, 55 and 60 deg., may be cut near the edge for threading short lengths.

EDITORIALS

1921—1922

WE HAVE come through a hard year together, not entirely unmarked, but still full of fight. If any far-seeing prophet toward the end of 1920 had predicted truthfully what was to happen in the twelve months to follow, his popularity would have suffered severely. That the machinery industry has withstood so well such a period of depression speaks well for its inherent soundness. There is also this to be said—all the frills and useless appurtenances of boom times are gone and our shops are ready to produce on a basis of rigid economy.

Unfortunately, such a sweeping statement cannot be applied to all of our merchandizing and distribution methods. During last year we brought out the big spread betwen the selling price and the cost of materials and direct labor in the case of one of our most efficiently built automobiles. Later investigations show the figures to have been typical, not only of automobiles, but of other products of the machine shop. In 1922 we shall give consideration to the sales problems which are engrossing the attention of executives everywhere.

The natural result of the slowing down of production was the release of the designers and engineers to complete the many projected innovations and developments which have been conceived during the war and in the boom following the armistice. Our columns reflected this condition by containing a number of new tool descriptions some 30 per cent greater than that of any previous year—in round numbers 650. Many others have been held back by the manufacturers and will be described in 1922 in the AMERICAN MACHINIST.

Features for 1921 were three big series—Metal Cutting Tools, Modern Production Methods and Tool Engineering. Next year we shall publish a strong series on machine tool designing by the author of Metal Cutting Tools. Tool Engineering will probably run through most of the year. Only one or two more installments of Modern Production Methods remain unpublished, but as soon as they have appeared we will commence a number of articles on two of the most interesting phases of modern management.

Sufficient automotive material is on hand for a number of issues and more is constantly being gathered. The railroad and car and locomotive shops are being visited by our field editors and will receive their share of attention. Other repair shop articles will come from the service stations and from machine shops of all kinds everywhere. Much of the material from the latter source will be published in the form of practical letters. Textile and paper machinery, small parts, press work—all will be covered in our "first thirty-two" pages.

Arrangements are being made to add to the value of the news pages. New correspondents, both at home and abroad, are being appointed, men who know the machinery industry and can sense news values. No stone is being left unturned to make the AMERICAN MACHINIST an absolute necessity to the progressive men of the machinery industry whether they sit behind the executive's desk or direct the operations in the shop.

It will take real ability to keep up with the procession in 1922. Business is coming back, but not the kind of business that knocks at the door and begs to be admitted

Prosperity lies just ahead for the fellow who is ready to meet it with a well-equipped shop, a good product, up-to-the-minute information and good old-fashioned push.

Resolve To Show Your Faith in the Future

NO MATTER how difficult the past year may have been, we believe every red-blooded American looks to the future, not only with hope for better business, but with an abiding faith that it cannot fail to come. Not a faith that expects miracles, not the kind of false optimism that looks for the overthrowing of all economic laws, but faith that this and other countries can and will overcome the causes of business depression and once more enjoy the prosperity that comes with earnest endeavor.

We have had severe and expensive lessons in the economic evils of over expansion. We have learned of the evils of combining speculation with manufacturing industries, frequently because of borrowed money being too easy to secure. But we also learned that united effort toward a common goal could work wonders in production; that real co-operation could be secured. The live, forward looking business men are not going to forget any of these lessons. They can and will be applied to secure the victories of peace as well as of war.

Normal prosperity, real prosperity means that when manufacturers are studying economic laws and are abiding by them, they secure an adequate return for their efforts. No one who has studied the past—who has faith in himself or in his fellow men—can doubt that this prosperity is on the way. Just when it will come no one can say. But its coming is sure and it will be hastened by those having the real faith putting their shoulders to the wheel and helping to start the load.

Let those who can, show their faith by beginning to buy the things they need, but which they have been putting off. If every man with faith in the future will resolve to buy what he can the tide of prosperity will begin to lap our shores in an incredibly short time.

Let your New Year's resolve be to show the faith that is in you by beginning to buy—NOW!

Comparing Prices With 1914

IN MAKING comparisons of machine tool or other prices with pre-war days, it is always well to consider values as well as prices. We should remember that over seven years have elapsed since the 1914 prices we talk about, and that in many cases the present machine bears very little relation to the old.

The changes in weight, design and efficiency should be carefully considered in making comparisons with 1914 prices, as is constantly being done. Buyers have a perfect right to demand a fair price—but they should consider all conditions carefully so as to know what a fair price really is.

Competition and the Cost of Selling

WE HAVE heard much about competition being the life of trade and about reducing prices to the consumer, but it doesn't always seem to work that way if we judge by the automobile industry. There is no lack of competitors and the real weeding out has not proceeded very far, but the cost of sales competition makes the buyer pay far more than he should for nearly every car at the present time.

With few exceptions the sales costs run from 35 to 70 per cent, averaging about 50 per cent, when everything is considered. There is one low-priced car on the market on which the labor cost is under $50, and which has never made a profit for the manufacturer on account of the cost of selling.

As a contrast to this let us look back at the boom days of bicycles. The large companies made millions at the high price charged. This induced competition in every cross-roads shop, so to speak, and the sales competition became so keen that most of them went broke, even the larger ones. At the present time, with a demand much larger than most of us realize, bicycles sell for not over 25 per cent of the former boom price and with only a very few builders in the field.

It seems to be possible for selling costs to increase with competition. Unless these costs can come out of production or profit the articles cost the consumer more than they would with fewer competitors in the field. And when the consumer knows this to be the case, as at present, he delays buying as long as possible.

The quickest way to remedy the situation seems to be for those with low production costs and good sales organizations to put their prices down to bed-rock. The price level must be based on replacement values and not on the cost of materials bought at high rates. This will shake out the weaker concerns, eliminate sales competition and cost, and benefit everyone but those who cannot stand the pace. It must be remembered that any undue rise in prices always induces more competition with its attendant ills.

Buying Machine Tools a La Automobile

THE machine tool industry has learned much from the automobile designer in the way of centralizing machine controls. In the modern car we have perhaps a seventy-five horsepower motor and a machine weighing two tons. Yet a slip of a girl, often weighing less than one hundred pounds, sits behind the wheel, controls the motor speed, operates the clutch, shifts gears and guides the car through crowded traffic while she calmly chews gum and discusses the latest play with her seat mate. It is the acme of centralized and convenient control and we are copying it in many ways.

The automobile industry might also be copied to advantage in some of its business methods. Not its high finance which is beginning to totter, but its methods of marketing. In most cases you pay a substantial deposit when placing the order—and you are not apt to cancel without a very good reason. The parts made by the car builder are guaranteed against defects for ninety days. Auxiliaries, such as starting motors, are not included—you go to the maker for adjustments on those.

You get a definite amount of service free—inspection and adjustment for perhaps the ninety days of the guarantee. On the ninety-first day you begin paying for service—as you should.

Another example is with tires. Most tire makers give some sort of a guaranty because it is demanded. Many adjustments are made in which the fault is with the drivers.

The newer method is to buy a tire with or without guaranty. If you want a guaranty you pay an added price to cover it, as an insurance premium. This is a business proposition. The man who wants a guaranty —or mileage insurance—pays for it. Those who prefer to depend on their own carefulness in avoiding rim cuts, bad roads, etc., buy tires at a lower price.

Storage battery makers are beginning to follow the practice of the tire makers.

Machine tool builders, but more particularly machine tool buyers, should study this problem carefully, for it resolves itself into a buyers' problem in both cases. If buyers want to secure machine tools at a *reasonable* price they must help the builders to remove *unreasonable* costs. They must face the facts that the unreasonable costs are not labor or material but the costs due largely to unreasonable demands for service, both before and after selling.

The whole matter is in the hands of the buyer. If he wants machine tools without service, or any but a reasonable guaranty that the machine is commercially perfect, he has only to refuse to pay the same price as the man who demands it. The cost of material, labor and overhead is not a mystery. Likewise the cost of service and guaranties can be readily figured.

This is a good time to begin a reformation in machine tool buying—and selling.

The Price of Special Machines

ONE of the most attractive fields of machine building is that of special machinery for doing unusual work. The high-grade machine designer revels in such opportunities and grasps them as an artist does a commission to paint a great picture. But from the financial side they are serious problems and are apt to leave a sad and sickening tale if on the wrong side of the ledger.

Unless the manufacturer who uses the machine has it built to his order he rarely realizes the costs that go into it and even then he is apt to consider them exorbitant. But when a machine already built is presented for his consideration he too often sets his valuation at the usual rate per pound, regardless of the production it can secure for him.

A good illustration is in some of the machines which have been designed for machining crankshafts and camshafts. Much ingenuity, as well as time and money, has been expended along this line and yet, even for the successful ones, the field is limited by the number of motor shops having a sufficient output to require one.

The price of such machines then must, in all fairness, be set at a figure which will reimburse the cost and leave a fair profit on the limited number which will probably be sold. If for example, there was a field for but ten machines, the total development cost must be paid for by these ten, regardless of the fact that a regular machine of similar size, weight and workmanship could be sold for a tenth of that sum.

Unless this is thoroughly understood there are very apt to be unpleasant recriminations and financial loss. And in cases where the field is necessarily limited, it is seldom wise to spend time or money on machines of this kind except on a definite order which covers all development expenses.

Shop Equipment News

Fellows High-Speed Gear Shaper

The Fellows Gear Shaper Co., Springfield, Vt., has recently placed on the market a spur-gear shaper intended for large-production work at high speed on

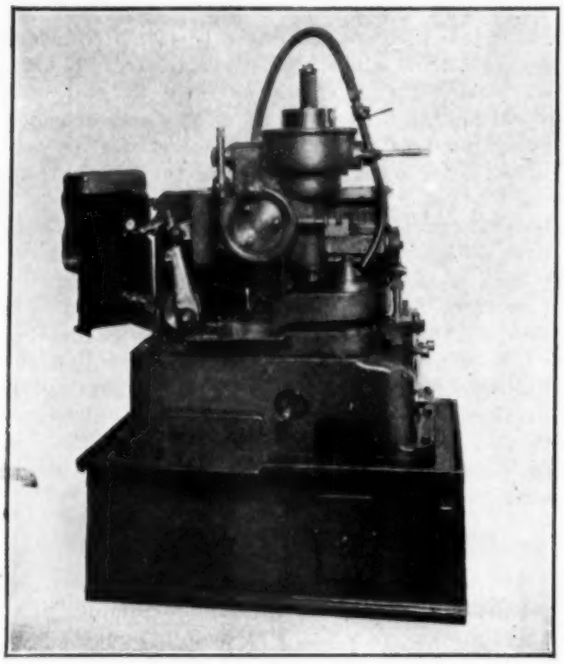


FIG. 1. FELLOWS HIGH-SPEED GEAR SHAPER

such gears as are ordinarily employed in automobiles. The machine, shown with the guards removed in Fig. 1, can perform roughing and finishing cuts automatically at the same setting and with the same cutter. Second-operation work is thus eliminated.

The principle of operation of the machine, which is designated as the No. 7, is fundamentally the same as in the Fellows standard gear shaper, in that a gear-type cutter is used to generate the teeth. Owing to the high speed at which the cutter is operated, and also to the short stroke of the machine, the cutting of gears in gangs is unnecessary, except for very thin gears. This is claimed to be an advantage, because it is difficult to secure accurate gears when holding a large number of blanks on an arbor or in a fixture at one time.

Because of the speed, the cutter remains in contact with the work for a very short period of time, and is said on this account to remain cool. Since the work also is kept cool, considerable changes in temperature do not occur to affect the accuracy. A large cutting-compound tank is furnished, so that sufficient coolant may be pumped to the cutter and work to keep them cool. The machine is intended to operate at exceptionally high speeds, so that by taking fine feeds the life of the cutter can be increased and its cutting edge not impaired, making it possible to use the same cutter for roughing and finishing. The method of obtaining the rotary feed for the cutter differs from that in the standard machine, in that this function is taken care of by gears.

The cutter spindle is of light weight, and is held in a straight path by guides. It is reciprocated by a light-weight connecting rod and crank arm. The operating end of the crank arm is provided with a hardened steel segment gear meshing with rack teeth in the cutter slide. The crank arm is bronze bushed at the fulcrum, and provided with ball bearings where it is attached to the connecting rod. The latter is operated through a crankshaft carrying an adjustable crankpin, the position of which governs the length of stroke of the cutter. The lower end of the connecting rod is mounted on a self-aligning ball bearing on the crankpin, permitting the use of high reciprocating speeds.

The crankshaft is made from an alloy-steel forging, and is driven from the rear by a single-pulley drive, so that the machine can be arranged for group drive through a jackshaft without need for a countershaft. Provision has also been made for the installation of individual motor drive, as shown in Fig. 2, a bracket being fastened to the top of the machine. A 1-hp. motor provides sufficient power. A more economical method of operation, however, when a group of the machines is installed, is to bolt the machine bases together and operate them as a unit. When this is done, one 6-hp. motor furnishes ample power for ten machines.

The saddle carrying the cutter slide is adjustable for different diameters of gears, and can be withdrawn to permit of locating and removing the work. For the depth feed, the saddle is advanced towards the work by means of a feed cam, provision being made on this cam

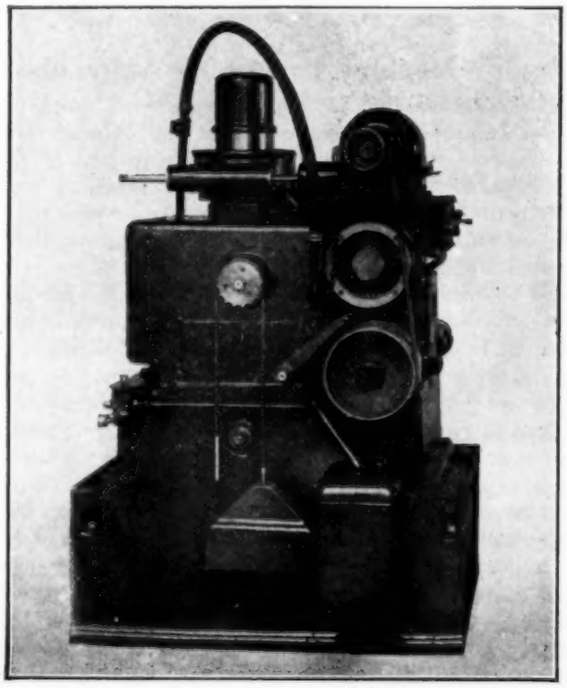


FIG. 2. REAR VIEW OF NO. 7 GEAR SHAPER

for taking both roughing and finishing cuts. The cutter is gradually fed to depth as the blank and cutter are rotated together, and the cutter overlaps on the finishing cut, so as to prevent variation in the thickness of the teeth around the gear.

The work spindle carries a reverse-taper arbor, and is held in an apron. It is rotated by means of a worm and index wheel, which are, in turn, directly connected to the upper worm and index wheel operating the cutter. The work is withdrawn from the cutter on the return stroke by a relieving mechanism, a cam located at the rear of the machine operating the apron lever through a connecting rod. The proper relation between the number of teeth in the cutter and that in the work is secured through change gears. Owing to the fact that the upper and lower worm wheels have the same number of teeth, the speed ratio between the cutter and work spindle is unity.

The time in which the gear will be completed is controlled by the speed at which the cutter spindle is operated, in conjunction with the feed gears located inside the machine, the latter being accessible by removing a plate. The rotary feed is expressed as so many strokes of the cutter per revolution, and gears are provided for securing seven feeds. The coarsest feed is 435, which means that the cutter makes 435 strokes for one revolution of the cutter; the finest feed is 1,735. Roughing and finishing cuts are taken at the same feed and speed.

The machine is intended to run with but little attention to the oiling. All the high-speed shafts are mounted on ball bearings, and are automatically lubricated. A reservoir in the bed holding 2½ quarts of machine oil is connected to additional auxiliary reservoirs, from which wicks carry the oil down to the different bearings. The cutter-spindle shoe and guide are oiled from a reservoir in the saddle housing. The only other reservoir is the one on the apron. There are only three grease cups on the machine, these being used because grease is considered more satisfactory than oil when there is an oscillating movement.

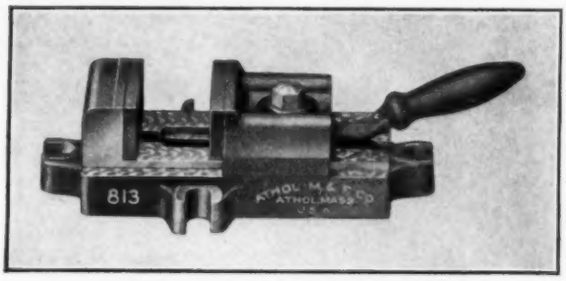
The shaper is intended to handle any form of gear entering into a standard automobile transmission, as well as some of special design. In adapting the shaper to the cutting of internal gears, a slight modification is necessary in the design of the machine, owing to the fact that for cutting an internal gear, the cutter must work on the right-hand side of the center of the work spindle, instead of on the left-hand side. For this reason, a special crank-arm is necessary.

By a slight modification in design, the shaper can be adapted to the cutting of helical and herringbone gears. Practically the only change is the use of helical in place of spur guides, the use of helical instead of spur cutters, and provision for changing over to cut either right- or left-hand helices.

Athol Milling Machine Vise

The Athol Machine and Foundry Co., Athol, Mass., has recently placed on the market the quick-acting vise shown in the accompanying illustration. The vise is particularly adapted to use on drilling and milling machines, the movable jaw being quickly operated by means of a lever. It has a range of from ⅛ to 5 in. The jaws are 3 in. wide, and consist of hardened steel plates held in place by screws. Special jaws can be furnished to suit particular work, so as to enable the more rapid and accurate clamping of the parts.

The bed is made of cast iron, being 10 in. long, 6 in. wide, and 2¾ in. high. Four lugs are provided for



ATHOL MILLING MACHINE VISE

clamping the vise to the table of the machine, and keyways are cut in the base to enable the proper registering of it. The clamping lever, which is made of cast steel, acts on a ⅝-in. steel bolt. The vise weighs complete 10¼ pounds.

Precision Permanent-Alignment Wheel-Truing Head

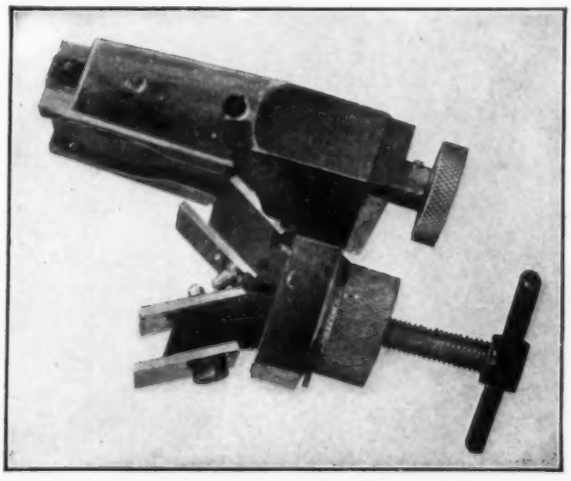
The Precision and Thread-Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., has added to its line the permanent-alignment wheel-truing head shown in the accompanying illustration.

The diamonds are simultaneously traversed by turning the T-handle shown at the right, but as one diamond is set in advance of the other they do not cut at the same time. The diamond holders are set at an angle of 10 deg. to the planes of the slides so that as the diamonds become dull, the holders can be turned to present new and sharp points to the wheel.

A stop provided for positioning the main slide, can be utilized for predetermining the amount of flat to be left on the face of the wheel for grinding U. S. S. threads.

Since, in grinding threads it is necessary to have the axis of the wheel inclined to the helix angle of the thread, provision has been made for inclining the truing head to the same angle so that the wheel will be formed to the proper shape.

The head is attachable to all models of "Precision" thread grinding machines by using an extended cap for the front bearing to which the head can be attached.



PRECISION WHEEL-TRUING HEAD

Gleason 4-In. Spiral Bevel Gear Generator

The Gleason Works, Rochester, N. Y., has recently placed on the market the spiral bevel gear generator shown in Fig. 1, the machine being intended especially

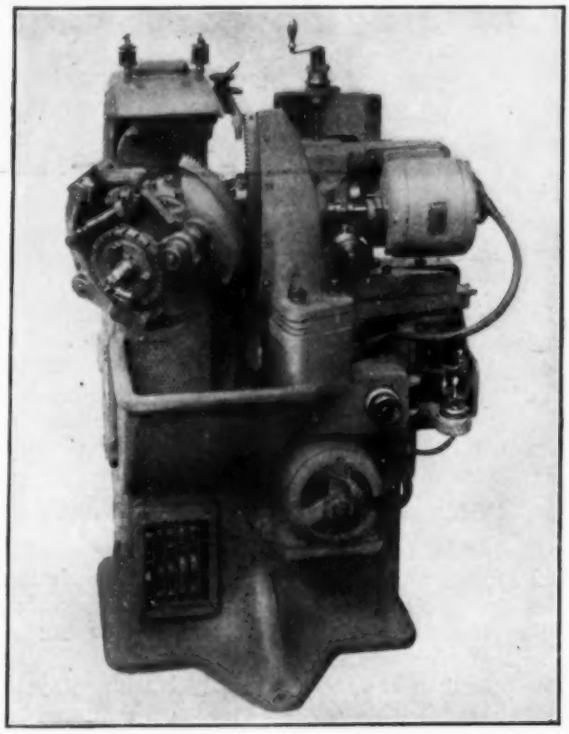


FIG. 1. GLEASON 4-IN. SPIRAL BEVEL GEAR GENERATOR

for the manufacturing of small gears in large quantities. The generating motion or roll is imparted to the work spindle and its carrier. The feed motion is given to the cutter spindle carrier only. The relative roll between the work spindle and the cutter is controlled by a crown gear and segment. Two motors are used to drive the machine, one driving the cutter and the other the feed and roll. Indexing is automatic and is actuated from the roll motion.

The machine is intended especially for finishing the teeth from the solid, finishing both sides of a tooth space with one generating cut by the "duplex spread-blade" method. A "completing cam" is used in the feed. The cycle of operations is as follows: The cutter, just before reaching the top of the up roll of the work, starts to withdraw. On the down roll, the cutter is swung clear of the work while the indexing takes place, and then is gradually advanced into the work during the remainder of the down roll. The cutter reaches the full depth of the tooth just after the beginning of the up roll, and the remainder of the up roll finishes the profile.

The machine can also be used with a reduced roll to rough out gears of the larger pitches, and then to finish the roughed blank by either the duplex spread-blade, or the single-side method. The position of the work and cutter is shown in Fig. 2. The cutters range in diameter from 1$\frac{1}{16}$ to 3$\frac{1}{2}$ in. The small cutters are made solid, and have four blades, two cutting on the inside, and two on the outside. The larger cutters have eight adjustable blades, four cutting inside and four outside.

The regular equipment consists of feed and speed change gears, eleven segments, an index plate, cutter gage, an automatic stop and a gear-driven coolant pump. Floor space is 33 x 46 in., and net weight 2,000 pounds.

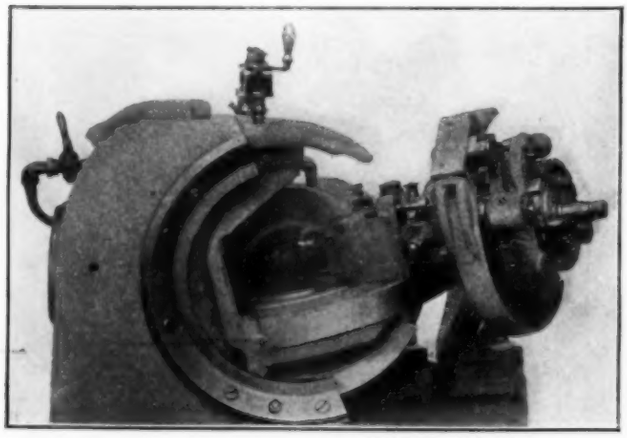
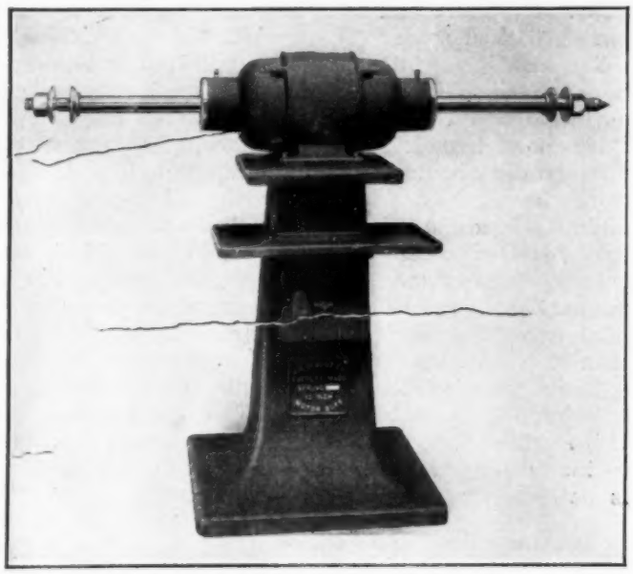


FIG. 2. POSITION OF WORK IN GLEASON GENERATOR

Blount A.C. Motor Buffing Machine

The alternating-current-motor buffing machine shown in the accompanying illustration has recently been developed by the J. G. Blount Co., of Everett, Mass. The machine is built in four sizes, $\frac{1}{2}$ hp. for wheels



BLOUNT A.C. MOTOR BUFFING MACHINE

6 x $\frac{1}{2}$ in., 1 hp. for wheels 8 x 1 in., 2 hp. for wheels 10 x 1$\frac{1}{2}$ in., and 3 hp. for wheels 12 x 2 in. S.K.F. ball bearings are mounted in dust-proof housings. The spindle is of high-carbon steel.

The head or motor unit is regularly mounted with a pan on a column, but may be supplied on a bench base. A tool tray is bolted to the column. A safety switch having a thermal cut-out is mounted on the column beneath the tool tray, which serves to protect it from the buffing compounds and also from abuse. The motor is of Westinghouse design. The entire machine is finished with an oil-proof enamel, thus making it easy to keep a clean, bright surface. The machine is regularly supplied for the following currents: The $\frac{1}{2}$-hp. motor for 110 or 220-volt, 60-cycle, single phase current, and the 1, 2 and 3-hp. motors for 220, 440 or 550-volt. 60-cycle, two or three-phase current.

Gordon Crankcheek Turning Lathe

The special purpose lathe illustrated has just been brought out by the Willard Machine Tool Co., Cincinnati, Ohio. It is the latest development in the line of

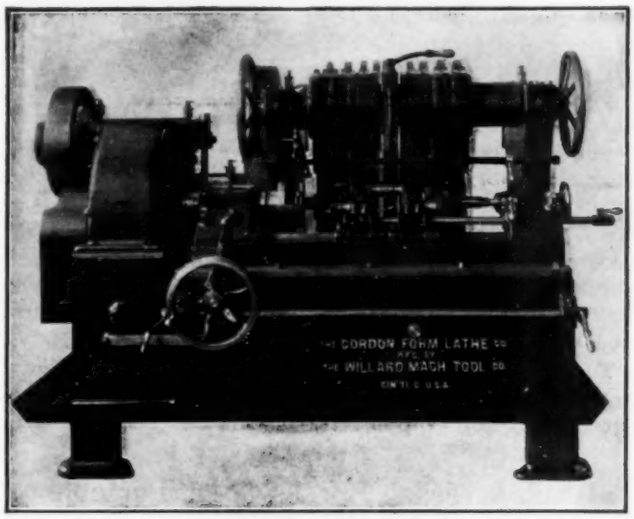


FIG. 1. GORDON CRANKCHEEK TURNING LATHE

lathes for turning cams and other irregular surfaces, built by the Gordon Form Lathe Co. for the past four years. The machine is designed to turn all the crankcheeks of a six-cylinder crankshaft simultaneously, the time for the whole job being only that required for one tool to traverse the width of one cheek. The particular lathe shown is one used by the Studebaker Corporation for turning up its four-bearing crankshaft which has eight cheeks.

In Fig. 1 are shown the relation of the various parts and the heavy construction made necessary by the simultaneous action of the eight cutters. The circular cutting tools are held in toolblocks which rotate in rocker arms swinging about the overarm shaft shown at the top of the figure. The oscillation of the rocker arm to permit the tool point to follow the contour of the work is controlled by the lower row of cams shown in the back view of the lathe, Fig. 2. Rotation of the toolblock to maintain the proper relation between the cutting point and the work is controlled by the upper row of cams.

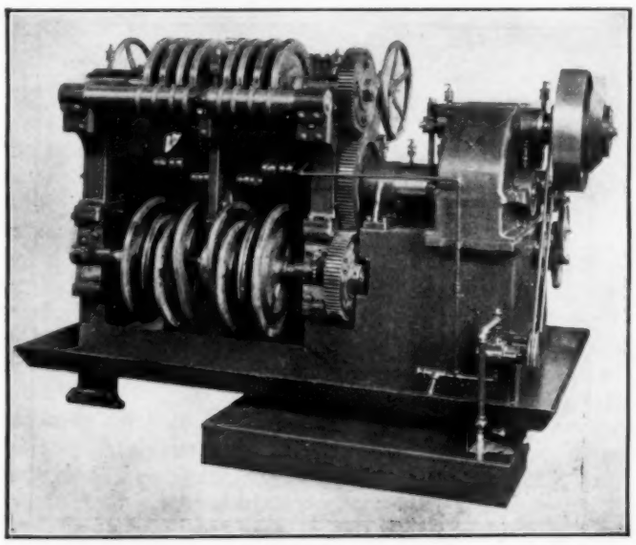


FIG. 2. REAR VIEW WITH GEAR GUARD REMOVED

The work is fed past the cutting tools by a screw which slides the platen longitudinally along the bed. A large range of feeds is provided through the gear train shown at the extreme right in Fig. 2.

The machine is started and stopped by either of the two horizontal levers at the ends of the shaft extending across the front of the bed just above the nameplate, Fig. 1. The feed is thrown in by the vertical lever just behind the handwheel at the left center of the bed, and is thrown out by an automatic trip. The handwheel returns the platen to the original position. The headstock, tailstock and steadyrests are bolted to the platen and travel with it as a unit.

Eccentric bushings at the ends of the overarm shaft may be rotated by the handwheels shown in Fig. 1, against stops which determine the position of the cutters for rough and finishing cuts. The lever above the middle support of the overarm shaft locks the shaft in position.

Drive is through a friction clutch and two intermediate gears to the main intermediate shaft, which is

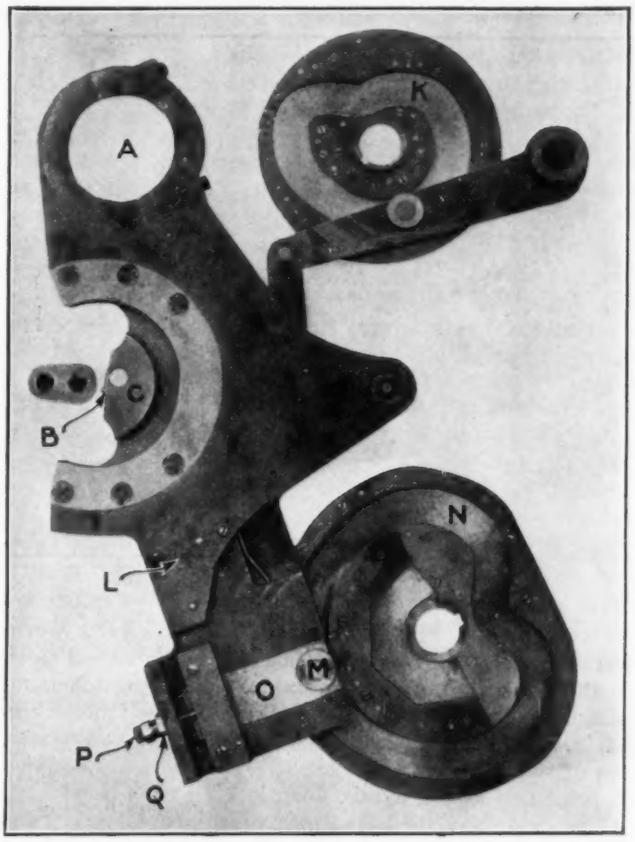


FIG. 3. ROCKER ARM AND CAMS

geared to the main spindle and the two camshafts by the gears shown uncovered in Fig. 2. These three shafts operate at the same speed. Gears run in oil.

The cutting lubricant is supplied by a No. 3 Brown & Sharpe pump through leads to the cutting points. Ample chip clearance is provided between the bottoms of the rockers and the platen. The chips fall into a chip pan and are removed through the large nameplate door in the front of the bed.

In Fig. 3 the relative positions of work, tool, toolblock, cams, rocker arms, etc., are shown. Fig. 4 shows the mechanism that rotates the toolblock. Returning to Fig. 3, *A* is the center of the 6-in. overarm shaft on

which the rocker arm swings, *B* is the cutting point which is at the center of the toolblock *C*. Rotation of the toolblock, therefore, does not change the position of the cutting point but does change the clearance angle. In Fig. 4 it will be seen that the toolblock *C* has gear teeth cut upon its outer edge which mesh with the teeth of the gear sector *D*. The gear sector pivots on a pin in the rocker arm and is actuated by the links *I* and *G* which get their motion from a roller at *J*. The links are fulcrumed on a shaft at *H* and the cam roller *J* is raised and lowered by the track cam *K*.

Motion of the cutting tool to conform with the contour of the crankcheek is secured by the action of the cam *N* on the hardened roller *M* in the foot of the rocker arm *L*. The roller *M* is adjustable by means of the screw *P* and locknut *Q* which move the slide *O* on which the roller is mounted. Spacing collars on the overarm shaft position the rocker arms above the crankcheeks and large guide plates fixed in the main frame guide the lower ends of the rocker arms and restrain their motion to a vertical plane at right-angles to the work centerline.

The circular cutter is 3 in. in diameter and is mounted

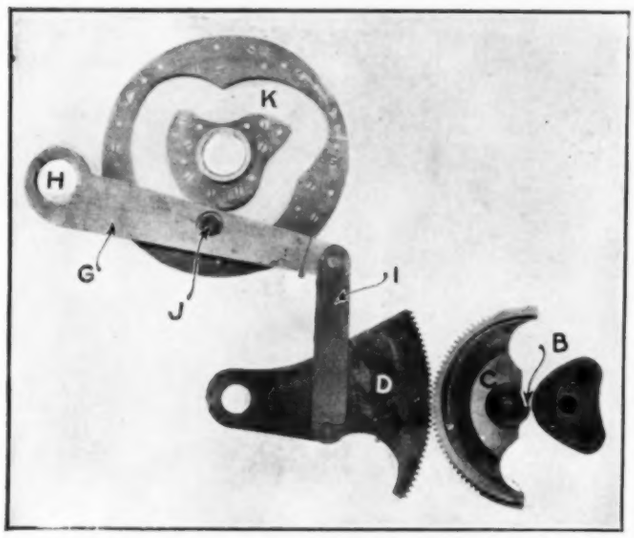


FIG. 4. CUTTER ROTATING MECHANISM

on a ⅜-in. stud. It is adjusted by means of a worm locked in the toolblock which meshes with hobbed teeth in the cutter. A gage is provided to facilitate setting of the tool after it has been reground. The toolblock is 14 in. in diameter and is guided between two plates, one of which appears in Fig. 3. The plates are doweled in place and locked by six flush locking nuts.

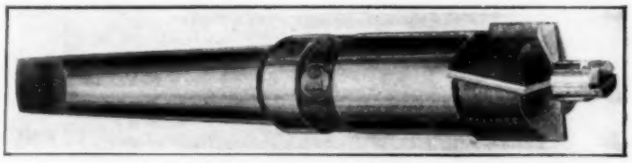
The cams are steel castings, machined all over, and the tracks are hardened and ground tool steel, made in sections and attached to the cams by dowels and filister head capscrews. The 3-in. camshafts have 7-in. plain end bearings and anti-friction center bearings.

Eclipse Junior Spot-Facing Tool

The Eclipse Interchangeable Counterbore Co., 1618 St. Aubin Ave., Detroit, Mich., has recently added to its line the spot-facing tool illustrated herewith.

The tool comprises a nickel-steel shank and holder, an externally and internally threaded pilot-nut (screwed into the holder), a high-speed steel facing cutter and a machine-steel pilot. The facing cutter is provided with a shank, ground to fit the hole in the holder so that when assembled both holder and cutter will be in alignment. The cutter is positively driven by flats on the shank engaging with a slot in the holder.

The pilot nut is screwed into the nolder and the threaded end of the pilot is screwed into it, binding the



ECPLISE JUNIOR SPOT-FACING TOOL

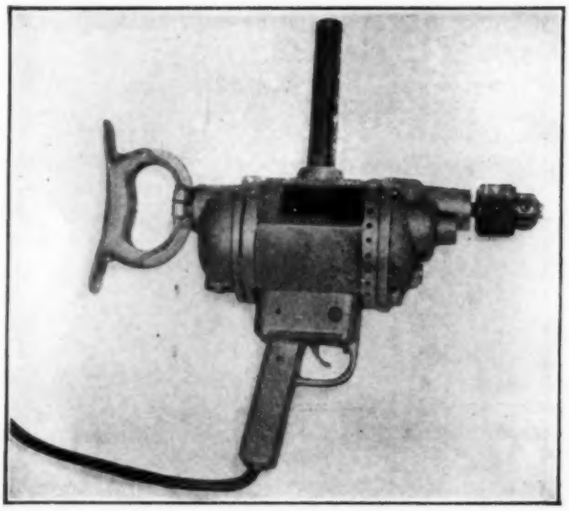
cutter securely in place. Pilot nuts having a variety of sizes of internal threads, enable the use of many sizes of pilots with the same holder. Holders are made having Morse tapers Nos. 2, 3 and 4 for facing cutters from ½ to 1⅛ in.; 1¼ to 1⅞ in. and 1⅞ to 3 in., respectively.

To enable users of Eclipse pin-drive holders and pilots to use the interchangeable spot-facing tool without the purchase of new equipment, adapters can be furnished.

Black & Decker Special ½-In. Portable Electric Drill

The accompanying illustration shows a portable electric drill, having a capacity of ½ in., recently placed on the market by the Black & Decker Manufacturing Co., Baltimore, Md. The principal features are the pistol grip and the trigger switch.

The housing is made of an aluminum alloy, and incloses a universal motor intended for operation on either direct or alternating current. It is ordinarily supplied for 110-volt current, although it can be furnished for 220 or 32 volts. A cooling fan is keyed to the armature shaft. The reduction gears are of chrome-nickel steel, are of stub-tooth form, and run in grease. By removing the cover plate on the switch handle, the terminal block and the motor leads may be quickly exposed, this feature being particularly useful when changing the cable. A three-jaw geared nut chuck, capable of holding straight-shank drills up to ½ in. in diameter, is furnished. The drill is provided with 15 ft. of electric cable, attachment plug, combination spade handle and breast plate, and detachable side handle. It weighs complete 15 pounds.



B. & D. ½-IN. PORTABLE ELECTRIC DRILL

Barber-Colman Automatic Hob-Sharpening Machine

An automatic machine for sharpening hobs and formed cutters, and intended to reduce the time of sharpening as well as to make possible the performance of such work by an ordinary operator, has been developed by the Barber-Colman Co., Rockford, Ill., and is shown in Fig. 1. The machine was designed primarily for sharpening hobs up to 4 in. in diameter and 4 in. in length, but it is applicable also to the sharpening of formed cutters.

The hob being sharpened is indexed at the end of each complete to-and-fro stroke, the mechanism provided to index for different numbers of gashes being adjustable and providing a means of easy change. The mechanism used to give the desired helical angle on the hob permits of ready adjustment. The feed provided is adjustable and actuates once for each revolution of the hob, regardless of the number of gashes. The faces of the hob teeth are ground or sharpened truly radial with the hob center, irrespective of whether the gash is straight or helical.

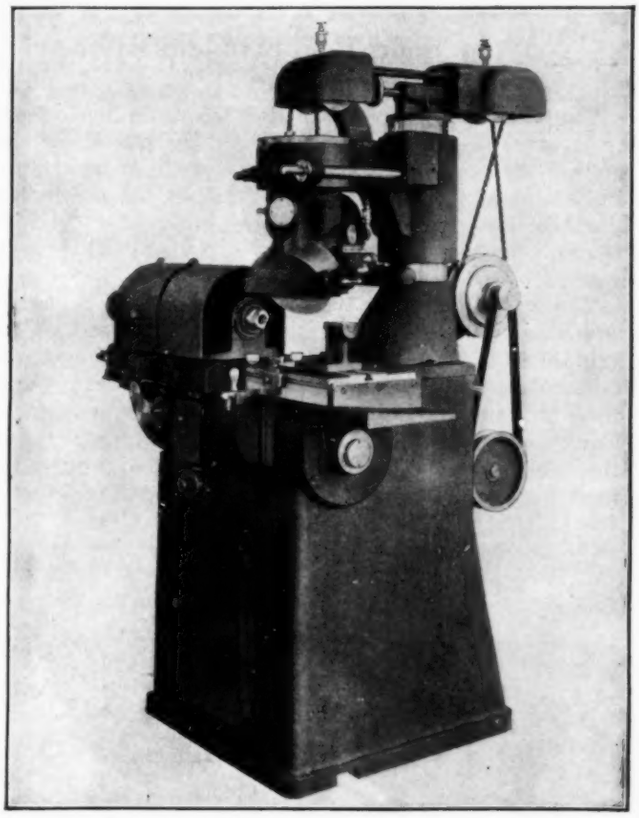


FIG. 1. BARBER-COLMAN HOB-SHARPENING MACHINE

The hob to be sharpened is mounted on a mandrel, carried in the headstock spindle, the outer end of the mandrel being supported by a sliding tail center. Both the spindle and tail center are mounted on a table which travels past the grinding wheel, having a fixed stroke of 7¼ in, and being actuated by means of a friction clutch. The operation of this clutch is at the control of the operator at all times, and can be thrown out of engagement at the end of any stroke.

The work-arbor spindle is provided with a No. 8 B.&S. taper hole, and runs in ball bearings. The rotating and indexing mechanism is located at the tail end of the spindle, being shown in Fig. 2. The index plate, which is the notched plate clamped and keyed to the tail end of the work spindle, may be quickly removed and replaced. It is made of hardened steel, the notches being ground. Indexing is positive and automatic.

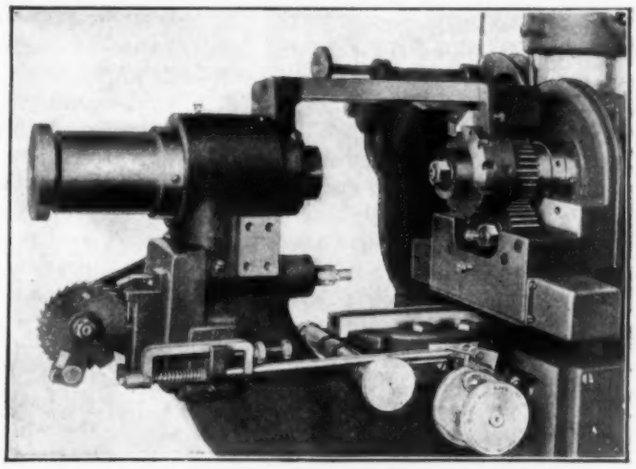


FIG. 2. FEED AND INDEXING MECHANISMS

The rotary motion for helical work is imparted by means of an adjustable swiveled guide actuating a rack under the sliding work table so as to turn a gear on the tail end of the work spindle. This guide is carried in a swiveled and graduated plate, which can be set at any desired angle by means of a knurled handwheel and worm. A fine-tooth ratchet can be seen on the tail end of the work spindle, with a counterpart at the extreme left end of the machine. The overhead bracket connecting these two ratchets is really a slide, and is fastened on the right to the arm on the tail end of the work spindle. It keeps the indexing parts on the spindle and the actuating parts at the left end of the machine in proper relation to each other. As the table moves toward the left, the two ratchets engage each other; and the dog, which until now has been engaged in the index plate, is lifted clear of the plate, leaving the latter free to rotate. Immediately after rotation begins, the dog is released and ready to snap into the next notch on the index plate. From that point to the end of the stroke, the left-hand ratchet together with the nut in

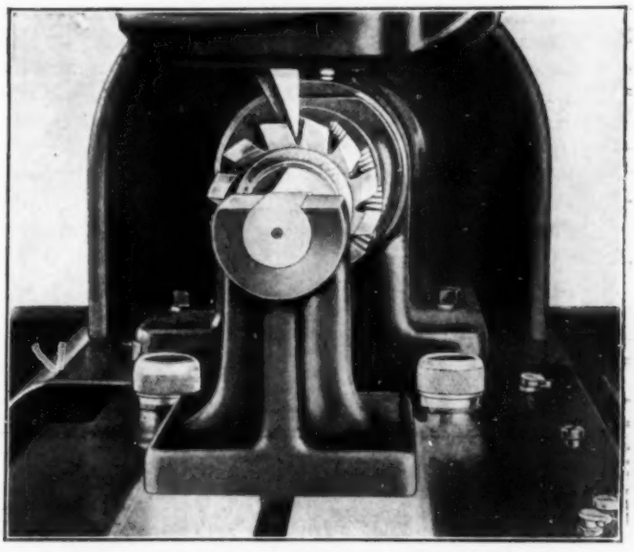


FIG. 3. SHARPENING A HELICAL-FLUTE HOB

which it turns, is pushed endwise against a strong spring; and is returned to its former position as soon as the table moves toward the right.

The mechanism which feeds the work against the grinding wheel is actuated only at the completion of each revolution of the hob, and is controlled by means of a thumbscrew regulator. The feed is adjustable to provide a motion of 0.0005 to 0.002 in. at the periphery of a hob 3 in. in diameter. Provision is also made for setting the feed so as to stop automatically after grinding any predetermined amount, so that a hob will not be spoiled should the operator be called away from the machine. A hood covers the entire indexing and feed mechanism, to protect it from flying grit and dust.

The grinding wheel is driven by means of an endless belt, provided with adjustable idler pulleys for keeping the belt at the proper tension. The wheelhead is carried on a heavy arm mounted with a vertical adjustment on the column. The grinding-wheel spindle is mounted in ball bearings which are carried in a sleeve, the whole unit being easily adjustable to bring the wheel to the diamond for truing. The wheel spindle is driven at the rear end through a pair of spiral bevel gears, which tend to eliminate vibration.

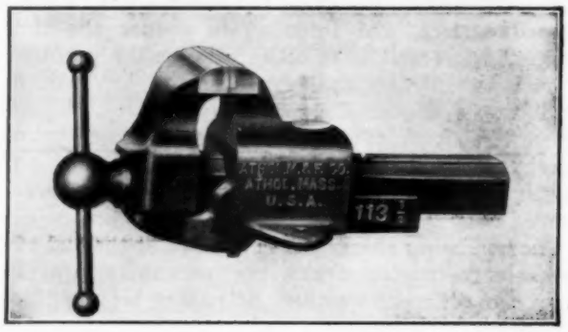
One feature of the machine is its provision for grinding a true radial face on the cutter teeth regardless of whether the cutter is straight or at an angle. This is accomplished by mounting the wheel spindle at an angle, as shown in Fig. 3, so that the vertical convex element of the saucer-shaped grinding wheel is directly over the center of the work mandrel; and also by having the wheelhead mounted in a swivel, so that the necessary angular adjustment may be obtainable for helically gashed hobs. The range of this angular adjustment of the wheelhead is the same as that provided for the work spindle, accommodating any angle, right or left, up to 90 deg. on hobs 3 in. in diameter.

A diamond dressing device built onto the head of the machine enables true radial grinding of the teeth, being so arranged that by means of a graduated stop the diamond can be set to the zero position regardless of its wear. However, if it should be desired to grind either a hook or a rake on the face of the cutter teeth, it can be done by setting the diamond forward or back of the zero position the desired amount and dressing the wheel in that position.

The machine is regularly belt-driven and a countershaft is furnished. When motor drive is desired, the countershaft is supplanted by a motor base and pulley. The regular equipment furnished includes one ¾ and one 1¼-in. work arbor, one 7-in. grinding wheel, a set of seven index plates for hobs having 10 to 16 gashes, table-drive and grinding-wheel belts and the necessary wrenches. The floor space of the machine is 42 x 50 in., and the height 72 in. The net weight is approximately 3,250 pounds.

Athol U-Beam Bench Vise

The Athol Machine and Foundry Co., Athol, Mass., has recently placed on the market the U-beam bench vise show in the accompanying illustration. The vise, which is stated to be more rugged than the oval-slide vise formerly made by the concern, is bolted to the top of the bench. It has a screw of the buttress type, operating in a malleable-iron nut. The jaws are of tool steel. The beam, eye and ball are unfinished, but the general overall finish of the vise is said to be smooth. The vise is made in four sizes, having widths of jaws of 2½, 3, 3½ and 4 in. The jaw openings are, respectively, 3½, 4½, 5½ and 6 in., and the weights 13, 21, 30 and 37 pounds.

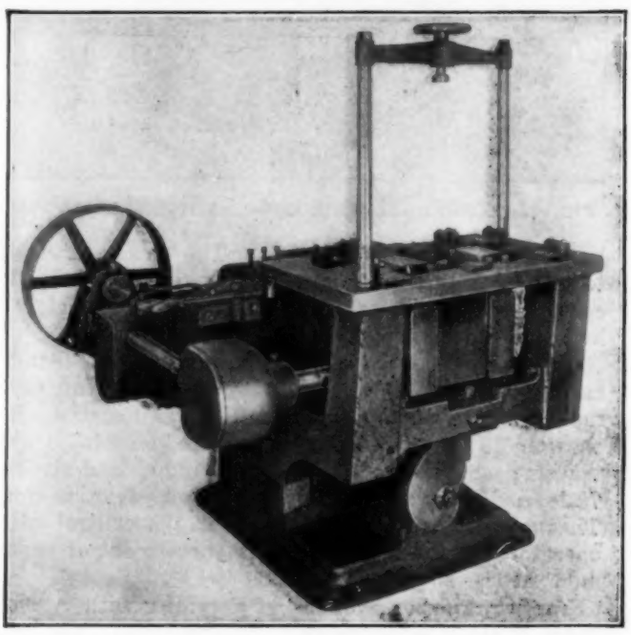


ATHOL U-BEAM BENCH VISE

Newton Model C-75 Straddle-Milling Machine

The accompanying illustration shows a cycle-feed-type, straddle-milling machine recently placed on the market by the Newton Machine Tool Works, Inc., Philadelphia, Pa. The machine is intended for facing the bearings for crankshafts in automobile cylinder blocks. The drive is by belt, and is transmitted through gears inclosed and running in oil.

The two spindles are mounted in substantial housings, and have individual hand adjustment to permit of regrinding the face-milling cutters. The motion of the table consists of a rapid advance downward, a slow feed for the cut, and an upward quick return to the loading position, where the table automatically stops on the level of the conveyor rolls. The table is provided with hardened steel jig plates. The clamping is done from above by a double-post beam clamp hinged at one end and supplied with a central clamping screw operated by a handwheel. Provision is made so that the rate of feed, or the time of one cycle, may be varied.

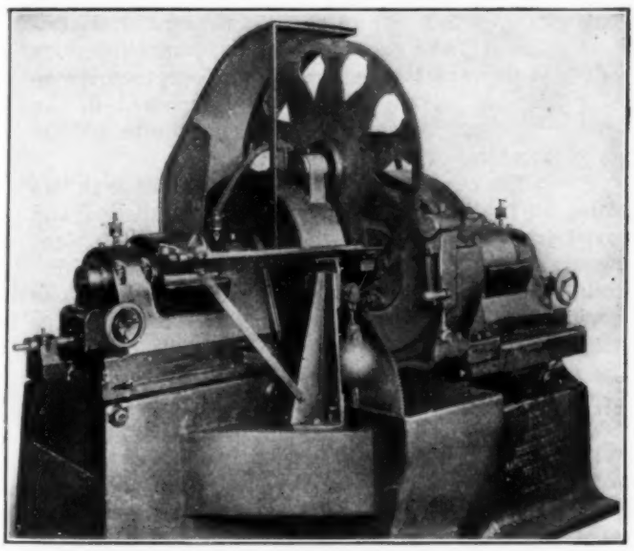


NEWTON MODEL C-75 STRADDLE-MILLING MACHINE

Gardner No. 1 Automatic Double Grinding Machine

The Gardner Machine Co., Beloit, Wis., has recently placed on the market the two-spindle automatic grinding machine shown in the accompanying illustration. The machine, which is known as the No. 1 double grinding machine, is intended for the rapid grinding of pieces having two parallel sides that require finishing, being adapted to the grinding of piston rings, ball and roller bearing races, sad-iron sole plates, thrust washers and similar parts. The openings in the work carrier, the large disk on the top of the machine, are made to conform to the shape of the work. They are here made to fit ball-bearing races and sad-iron plates, although by the use of inserts they may be made to conform to the shape of other pieces.

The spindles of the machine are offset with relation to each other. When the grinding requires the use of a coolant, the grinding members consist of two 24-in. abrasive ring wheels carried in "Perfection" chucks. For dry grinding, steel disk wheels 24 in. in diameter are employed. The parts to be ground are carried into the grinding position by the work carrier, which is a



GARDNER NO. 1 AUTOMATIC GRINDING MACHINE

large circular disk passing between the grinding members. In order to accommodate a variety of work, the carrier is provided with a range of feeds from six to forty pieces per minute.

The position of the grinding members may be adjusted by means of a handwheel operating through a worm gear and screw, graduations being provided up to 0.0001 in. Provision is made for accurately aligning the spindles of the machine. The work carrier is ordinarily provided with either five or ten openings for work. As it brings a piece of work into the grinding position, one of the grinding members automatically advances until it reaches a positive stop. Since this member approaches the work under spring pressure, it advances only as rapidly as the stock is removed, thus preventing danger from over-feeding. The member is returned to its open position by the action of a cam, and the work as it passes from between the wheels is automatically unloaded. Thus, clearance is provided for the entrance of the next piece of work.

Each grinding member is mounted on a head, which slides upon ways to provide the feeding motion just mentioned. Steel collars carry the thrust. When grinding small work that permits of a high rate of feed, an automatic feeding device for the carrier is employed.

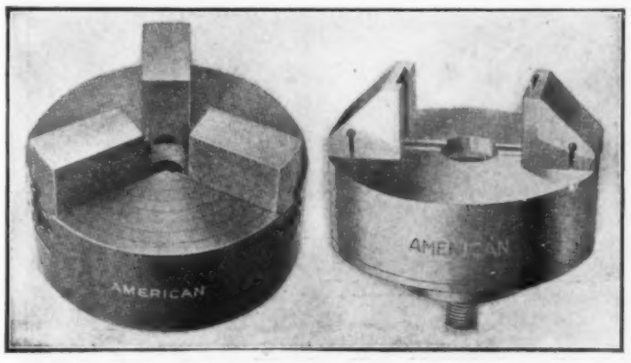
Devices for trueing the grinding members are integral with the machine, although they do not interfere with the action of the machine and are brought into use only when desired. The spindles are made of alloy steel and mounted in bronze bearings adjustable for wear. Shields are provided to exclude dirt from the ways. Gibs are provided to take up the wear on the sliding parts, and means of lubrication are provided for all bearings.

S-P "American" Air Chucks

The S-P Manufacturing Co., 872 East 72d St., Cleveland, Ohio, has recently placed on the market the air-operated chucks formerly made by the American Air Chuck Co., Chicago, Ill. The standard sizes of the chucks range from 6½ to 18 in. capacity, although larger chucks can be furnished. At the left of the accompanying illustration is shown the three-jaw combination chuck, while at the right is shown a two-jaw chuck. Both types are intended for general manufacturing purposes, holding work either internally or externally. Special jaws or master slides to take false jaws can be furnished. The chuck bodies are made of one-piece semi-steel castings, and resemble those ordinarily employed in lathe chucks. The chuck is heavily built; because of its short length, it tends to eliminate chattering.

The sector levers are made of alloy steel, and operate the chuck slides to obtain the universal movement of the chuck. They are fastened to steel blocks which fit in the body proper. Heavy ribs running the entire width of the body reinforce the chuck and provide seats for the sector block to fit in. Since the nose of the machine spindle, or the faceplate, rests against the back of the sector blocks, the strain of the work bears on the end of the machine spindle. A flanged steel dust bushing is riveted to the body of the chuck, and prevents it from spreading in the front.

To obtain the gripping action, a roller movement is employed. A cam movement is used at the outer end of the sector lever. The air may be shut off in the cylinder and the work still firmly held. Where a very long pilot bar is used, the pilot bushing can be employed to guide the bar, and the cam bushing can be made any desired length. The sector levers operate in a pocket of the jaw at a ratio of 2½ to 4½. Should the air supply fail entirely, the chuck can be hand operated merely by placing a bushing between the cam bushing and the faceplate.



S-P "AMERICAN" AIR CHUCKS

"Tri-Way" Universal Horizontal Boring Machine

A horizontal boring machine, shown in Fig. 1, has recently been completed by the Universal Boring Machine Co., Hudson, Mass., and is now ready for the market under the trade name, "The Original Tri-way Universay (Horizontal) Boring Machine." From a feature of the bed the machine derives its name "tri-way," there being three instead of two guiding ways provided for the carriage. The latter is gibbed to the center and front ways, while the rear way supports what would otherwise be overhand, and enables the table to hold longer and heavier pieces. The levers controlling the various movements are grouped so as to be within easy reach of the operator.

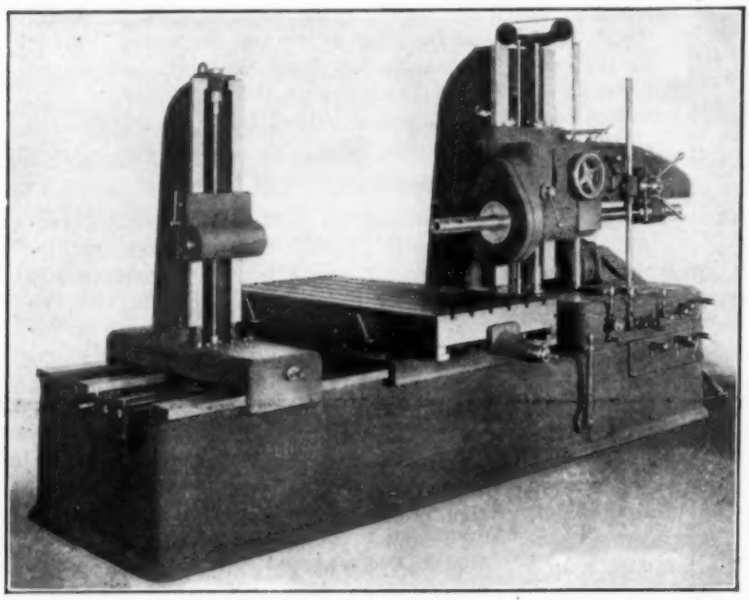


FIG. 1. "TRI-WAY" UNIVERSAL HORIZONTAL BORING MACHINE

A pump may be attached when it is desired to use cutting lubricant, and troughs or sluice-ways are provided to carry the overflow to a settling basin and tank. The tank is inside the base and contains the pump, which is completely enclosed, with only the driving shaft and pulley extending. Access to the tank and pump is provided for by a large door in the back of the base, and clean-out spaces allow the removal of chips without interfering with the progress of the work.

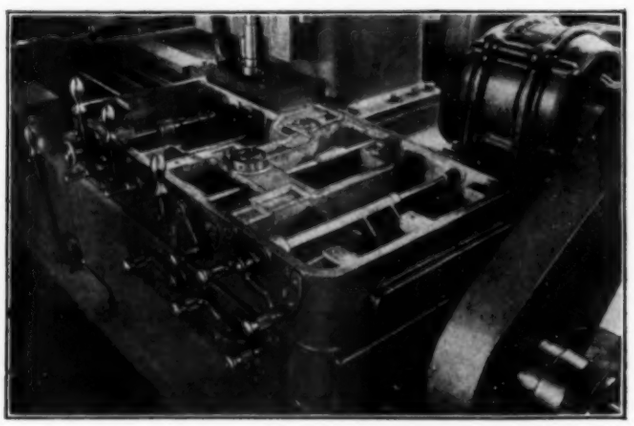


FIG. 2. GEAR TRAYS WITH COVER REMOVED

The base extends beyond the head and provides a rigid support for the motor, which drives the main shaft through a Morse silent chain, thus making the machine self-contained. All speed and feed change gears are located in two flat trays, one above the other, and also supported upon the extension of the bed. By removing the cover of the upper tray, as in Fig. 2, the feed gears and their related parts are easily accessible from above, while by withdrawing six capscrews the entire tray may be lifted off, giving access to the parts of the speed-change mechanism. Both trays may be removed as a unit without interfering with other parts. All the gears are of steel and run in oil.

The machine carries a 4-in. bar. The bar-carrying heads are moved up and down simultaneously and may be fed by power in either direction. Power crossfeed in either direction is provided for the table, as is also power traverse to the carriage. Any movement to which power feed is applied has also a rapid movement. The lever which operates this rapid movement must be held in engagement by the hand of the operator. Automatic knockouts are provided, to prevent over-running. The mechanisms of the levers interlock to prevent the engagement of opposed movements. A friction slip is interposed in the drive to prevent damage from the accidental blocking of any movement.

The outer support for the bar is made in two sections, so that the upper part may be unbolted and removed from the machine when it is desired to place long work on the table, while the lower part is not disturbed. The upper part is doweled to the lower and can be replaced without the necessity for realigning the bearing for the bar.

The machine is made in two sizes, with three lengths of bed. The distance from the faceplate to the outer support is either 72, 96, or 120 in., and the vertical travel of the bar heads is 30 or 36 in. The table has a working surface of 30 x 36 in. or 36 x 75 in. The spindle speeds range from 7 to 284 r.p.m. in geometric progression, and the feeds may be from $\frac{1}{8}$ to $5\frac{5}{8}$ in. per minute, irrespective of the spindle speeds. The machine shown covers a floor space of 17 ft. x 9 ft. 5 in., and is about 8 ft. high. The weight is approximately 20,000 pounds.

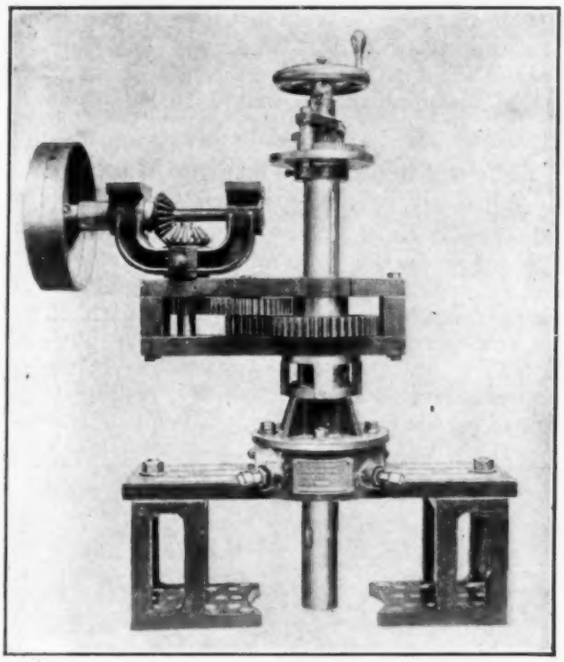
Pedrick Boring Unit

The accompanying illustration shows a portable boring unit recently placed on the market by the Pedrick Tool and Machine Co., 3638 North Lawrence St., Philadelphia, Pa. The device is very similar in construction to the driving end of the portable taper boring bar described on page 903, Vol. 55, of the *American Machinist*. It consists of four members, the bar, the feed mechanism, the driving gear and the crosshead mechanism.

The bar is of the standard type. It is 3 in. in diameter and 3 ft. long, having a travel of 18 in. The lower end of the bar is bored out with a taper hole to permit of holding tools. A feed screw having a square thread is embedded in a groove almost the full length of the bar. The outer end of the bar carries the feed case. By blocking the motion of the handwheel, the feed becomes automatic. Two changes of feed are ordinarily

provided, although three may be furnished for special work. The compounded driving gearing is enclosed in a strong frame. Power may be applied by belt, by motor, or if necessary, by hand.

The crosshead supports the guide for the bar. Space



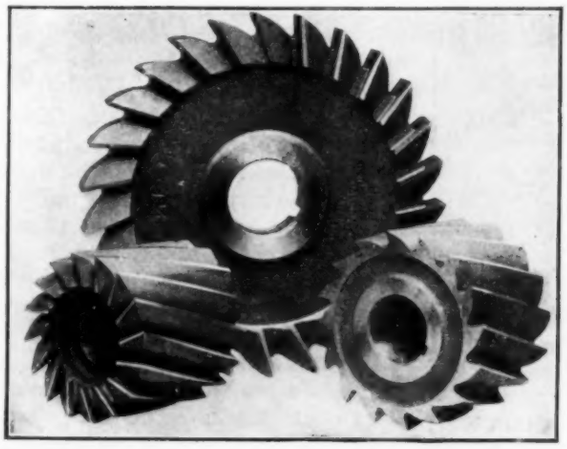
PEDRICK PORTABLE BORING UNIT

blocks provide room between the work and the end of the bar, and permit of different arrangements so as to fit work of different types. Setscrews are provided for centering the bar in the hole. The unit may be operated in any position.

National "Parabolic" Milling Cutters

The National Twist Drill and Tool Co., Detroit, Mich., has recently placed on the market milling cutters of the type shown in the accompanying illustration, and designated by the name of "Parabolic." In order to make the cutter tooth of uniform strength throughout its length, the shape adopted is that of a parabola slightly modified at the small end. The number of teeth used is nearer to that of the conventional fine-tooth cutter than that of the coarse-tooth type. In order to get the most effective chip thickness per tooth without excessive peripheral speed, a fairly large number of teeth was found desirable. Considerable research work on the action of milling cutters was done in order to ascertain the most efficient form of tooth.

The parabolic cutters are made in plain-side and end-mill types, as well as in special designs to suit particular purposes.

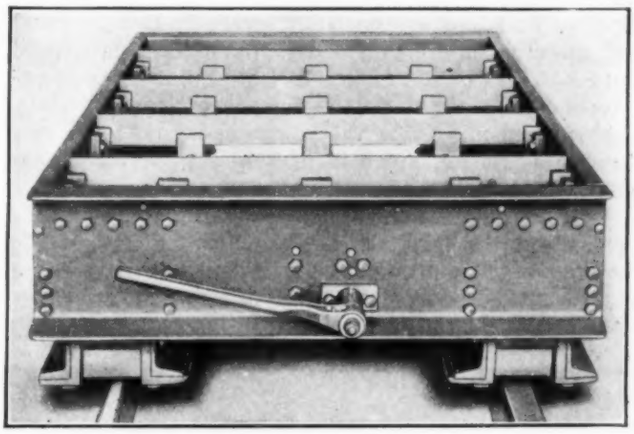


NATIONAL "PARABOLIC" MILLING CUTTERS

Harrington Truck Tables

The illustration shows a truck table recently placed on the market by Edwin Harrington, Son & Co., Inc., Philadelphia, Pa., for the handling of large work. The tables are particularly adapted to use with straight-rail or fully adjustable multiple-spindle drilling machines, as they permit of moving the work all the way out from under the machine for changing it, or of moving it in small steps to obtain any desired indexing. The device is made in a standard design, although features may be changed to permit of any surface dimensions, number of wheels, character of top surface or method of movement.

The frame is ordinarily made of channels with the flanges turned out, and with the trucks and the intermediate supporting I-beams bolted on the inside. Cast-iron members fastened on the inside of the frame have vertical slots to hold 4 x ½-in. work-supporting bars. Ordinarily, these bars are covered with planks, so that the cutting tools may easily penetrate. The wheels are mounted on roller bearings carried in cast-iron housings.



HARRINGTON TRUCK TABLE

Two trucks are ordinarily employed, but a greater number of wheels can be used for a table of great size or weight. The front and rear wheels of one truck are turned with double flanges having angled sides in order to mate with the head of the rail, which is planed to V-shape and guides the table in a straight line. The other wheels have smooth unflanged treads.

Movement of the table is usually accomplished by means of a hand ratchet lever at the front, which drives the front wheel of each truck through gears. When desired, a compound-wound, direct-current motor is mounted below the table and geared to the drive wheel shaft, so as to move the table at a rate of about 60 in. per minute. It is controlled by means of a push-button automatic starter, and is said to be controllable to give movements as small as 0.01 in. The table can be supplied with a cast-iron top having T-slots and pin holes, if desired.

Pratt & Whitney Die-Sinking Machine

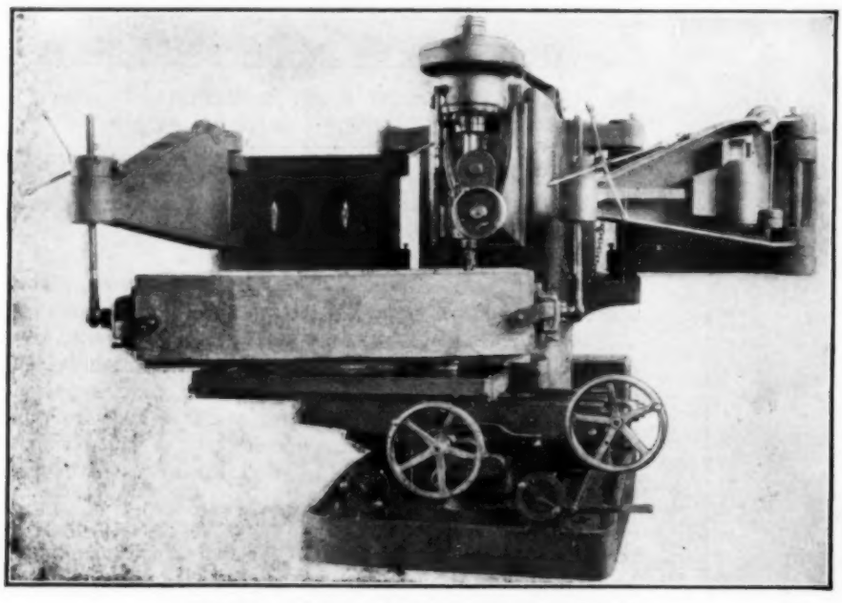
A die-sinking machine intended especially for work on large dies has recently been placed on the market by Pratt & Whitney Co., Hartford, Conn. By means of the "Bayrer's compensating arms," as shown in the accompanying illustration, a die weighing four tons may be suspended by elevating screws, and readily placed in position on the table, then swiveled, tilted or turned on edge by the operator. The hand feeds are thereby rendered sensitive to light cuts and the die may be fed over to the extreme limits for cutting the gates. The compensating arms may be folded back and latched against the sides of the column. They are carried on roller bearings supplemented by ball bearings, so that the die can be very easily moved.

Both of the outer carrying arms are provided with balancing beams and adjustable weights, by means of which the load of the die can be approximately balanced and thus relieved from the table. Clamps are attached to the end of the die block to provide trunnions by which the die may be supported. When it is desired to tip the die, the table is lowered so that the arms sustain the entire load. The machine is of the knee type, so that the die can be elevated by power to bring the cut to a level convenient for the operator. The table ordinarily is very low, so that platforms are unnecessary.

The cutter spindle is mounted in a counterweighted vertical head provided with hand feed. There is also a rapid traverse for the quick adjustment of the head. Power is transmitted through a quarter-turn belt from the gear box in the rear of the machine. All changes of speed and feed are made by levers in front. Hand and power feeds are provided for both the longitudinal and crossfeeds of the table. In addition, a rapid power traverse is provided for all movements of the table. The mechanism driving the power movements operates through a friction clutch to prevent injury in the case of over-running.

A cherrying attachment may be readily applied to the cutter head, the drive being effected through gearing to the nose of the cutter spindle. When not in use, the attachment is swung back out of the way and does not interfere with the operation of the machine. The machine may be driven either from a line shaft or from a motor mounted on the rear of the base. If desired, it can be supplied without the die-carrying arms.

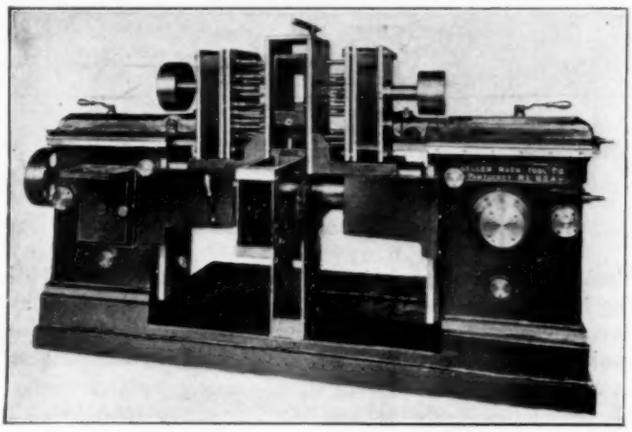
The dimensions of the table are 22 x 48 in. It has a longitudinal feed of 48 in., a crossfeed of 17 in., and a vertical feed of 15 in. The vertical feed of the cutter head is 12 in.; and the spindle speeds twelve in number, ranging from 27 to 790 r.p.m. The floor space required is about 10 x 10 ft., the height of the machine 9 ft., and the approximate weight 15,000 pounds.



PRATT & WHITNEY DIE-SINKING MACHINE

Sellew Automatic Drilling Machine

The Sellew Machine Tool Co., Pawtucket, R. I., has recently placed on the market an automatic drilling machine for production work on parts requiring multiple drilling on opposite sides. In the accompanying illustration, the machine is shown at work with 60 drills upon a box casting 24 x 18 x 6 in. in size. The work is changed in one arm of the work holder at the front of the machine at the same time that drilling is being performed on the work between the heads. During the period when the drill heads are in the withdrawn position, the work holder is revolved to bring a new piece in position in the jig. Both heads move forward simultaneously. The operation of the machine is continuous and automatic, the operator merely changing the work at the front station and indexing it through the jig. The drill spindles are mounted in radial and thrust ball bearings and the drills run at speeds proportionate to their diameters, each kind of work requiring different heads.



SELLEW AUTOMATIC DRILLING MACHINE

The feed is arranged so that its movement is similar to that obtained by hand feeding; that is, the drill is slowed at its entrance into the work and also when it breaks through. The heads have a quick return. The drill head slides are arranged to carry different heads, which can be changed very quickly. The saddles on the table for carrying the jig are adjustable to provide for a wide range of work. The machine is about 10 ft. long and weighs about 5,000 pounds.

Harrington No. 19 Multiple Drilling Machine

A multiple drilling machine of the rail type is shown in Fig. 1. It has been placed on the market recently by Edwin Harrington, Son & Co., Inc., 17th and Callowhill Sts., Philadelphia, Pa. The chief feature of the machine is the in-and-out movement provided for each spindle to permit of drilling irregular patterns, the construction of the heads being shown in Fig. 2. The machine is shown with only two spindles, but four are ordinarily furnished, the construction being such as to permit of small distances between centers. Any type of table may be used, either as a component part of the frame or as a separate unit to stand or roll on the floor. The driving pulleys will transmit 25 hp., which is said to be ample for the driving of four 2-in. drills.

The transverse movement of each spindle head on the

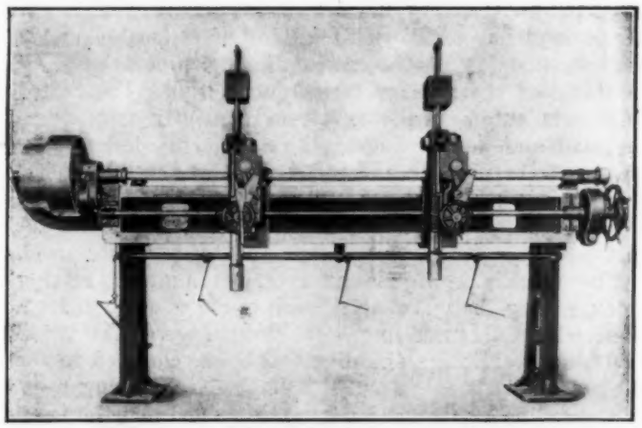


FIG. 1. HARRINGTON NO. 19 MULTIPLE DRILLING MACHINE

small arm is operated by means of a screw. Ball bearings are provided for spindle thrust and also under the counterweight yoke. By means of a clutch on the driving gear, any spindle may be stopped independently of the others. The arms are provided with rollers to take both the downward and the overhanging loads, so as to permit of easy movement on the crossrail.

The feed may be operated universally for all spindles from the right-hand end of the machine, or separately for each spindle at the end of each arm. The feed motion is driven by belt from the top shaft and operates on all spindles at the same rate. There is a large conical friction clutch at the end of the crossrail to provide quick vertical movement for the spindles. A handwheel on each head provides means for moving the spindles up and down independently and for setting them at the proper height when universal feed is used. Automatic stops are provided to disengage each spindle at any predetermined point.

When belt drive from an overhead countershaft is used, a two-step cone pulley and back gears are provided, giving four spindle speeds. Motor drive of different types can be used, although an adjustable-speed motor driving by belt to a single pulley is stated to be preferable.

The crossrail is of heavy box section. The uprights are I-sections securely bolted to the crossrail and base members. A table suited to the type of work to be handled can be furnished. A pump and distribution manifold are provided to give continuous supply of cutting lubricant. The dimensions of the machine can be made to suit the requirements. Ordinarily the greatest distance between the end spindles is 10 ft. 9 in., the vertical traverse of the spindles 15 in., and the in-and-out movement of the spindles 14¾ in. The floor space

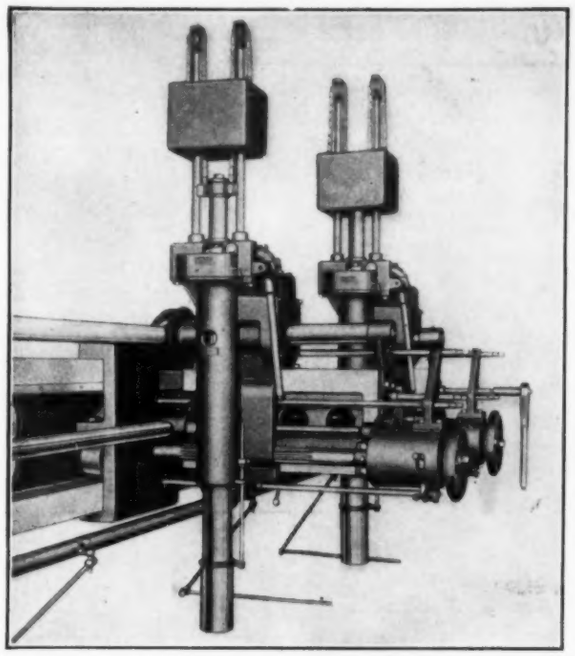
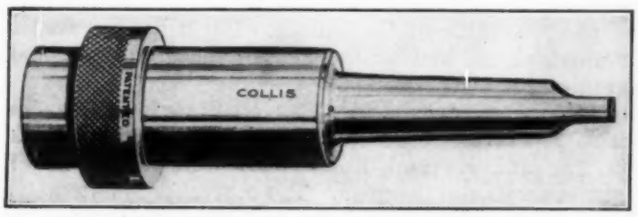


FIG. 2. HEADS ON HARRINGTON DRILLING MACHINE

without a table is 17 ft. 10 in. x 7 ft., the height overall 10 ft. 2 in., and the weight with belt drive 14,850 pounds.

Collis "Wonder" Quick-Change Chuck

The Collis Co., Clinton, Iowa, has recently placed on the market the quick-change drill chuck shown in the accompanying illustration, and sold under the name "Wonder." The chuck is adapted to use on drilling machines, lathes, screw machines and other machines having revolving spindles, and it permits of the rapid change of tools without stopping the rotation of the spindle. It is said that the chuck can be easily op-



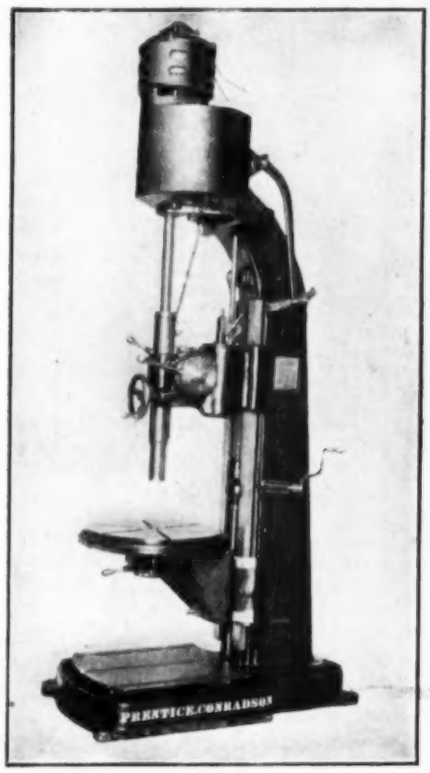
COLLIS "WONDER" QUICK-CHANGE CHUCK

erated with one hand, and that collets can be inserted without the necessity for the operator's hand touching the chuck itself even when revolving at 1,500 r.p.m.

The collets have taper shanks, thus enabling accurate fitting in the chuck. Collets for holding different tools, such as taper shank and straight-shank drills and hand taps, can be furnished. A special collet is provided for the holding of drills having twisted tangs or broken shanks. The chucks are made in six sizes, having standard taper shanks from Nos. 1 to 6, and outside diameters from 1⅛ to 5¼ in. The collets are also made in a range of sizes to fit the chucks, and to permit of holding drills and tools of different sizes.

Prentice Conradson 32-In. Vertical Drilling Machine

The vertical drilling machine shown in the accompanying illustration has recently been placed on the market by Prentice Conradson, Green Bay, Wis. The machine shown has a swing of 32 in., although the maker states that it will also be built in 25- and 36-in. sizes. The frame of the machine is cast in one piece, the headstock, column and base being a single casting. The table is ordinarily 24 in. in diameter, but rectangular and sliding tables can be supplied. The principal feature of the machine is in the mounting of the driving motor, the arrangement being such as to eliminate all moving parts possible The hollow armature of the motor, the two intermediate shafts carrying gears and the spindle sleeve are mounted in ball bearings, and are oiled continuously from an oil bath. A ball thrust bearing is provided for the spindle. All the gears used are heat-treated alloy steel. There are nine spindle speeds ranging from 34 to 500 r.p.m., and obtained by means of sliding cluster gears mounted on splined shafts. Six feeds are provided, the range being from 0.006 to 0.035 in. per revolution of the spindle. Rapid hand traverse is provided, as well as the usual hand feed, stop and depth gage.



CONRADSON 32-IN. DRILLING MACHINE

Both the motor and the controller are fitted to the machine. It is stated that the controller gives quick starting and reversal, as well as protects the motor against accidental overload. The controller is automatic in that the small master drum operates a clapper switch through a magnet, and at the same time the inverse-time-element protective device prevents abuse for short overloads without stopping the motor. A no-load protection is also included. For tapping purposes, the motor is merely reversed. Either a.c. or d.c. motors can be supplied.

Ordinarily a 3-hp. motor running at 1,200 r.p.m. is used, although for extra heavy work a 5-hp. motor running at 1,800 r.p.m. can be employed. It is stated that the machine can drive a 3-in. high-speed-steel drill in steel. The floor space required is 30 x 54 in., and the height of the machine to the top of the spindle 11 ft. 8 in. The net weight is approximately 3,700 lb., and contents boxed for export 135 cubic feet.

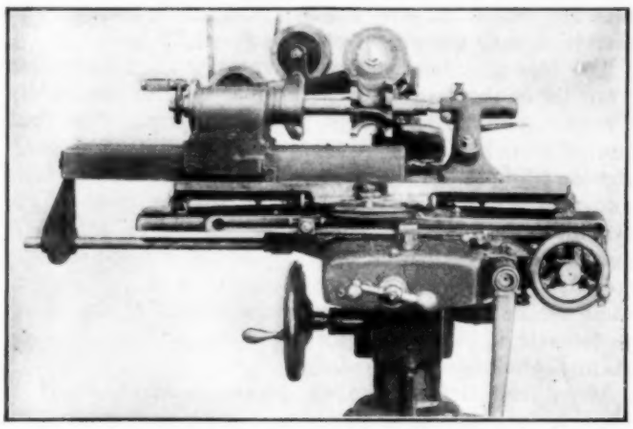
Le Blond Attachment for Grinding P. & W. Curvex Cutters

The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, has recently placed on the market an attachment for application to its universal toolroom grinder, so as to enable the grinding of helical hobs and the "Curvex" cutters made by the Pratt & Whitney Co., Hartford, Conn. The cutters can be ground in diameters up to 5½ in. and lengths up to 7¼ in. The maximum travel of the attachment is 8⅜ in. A wheel 5 in. in diameter and having a 15-deg. side is recommended. Since the flutes of the Curvex cutters are helical, the attachment is arranged to grind leads of from 9⅛ to 172 in. per revolution.

The cutter to be ground is mounted on an arbor between the centers of the attachment, as shown in the accompanying illustration, the machine table is set to zero, and the taper guide bar of the attachment is set to the required angle. This guide bar is located under the long housing on the left of the machine table. As the table of the grinder is fed horizontally, the cutter spindle is automatically revolved in proper relation to the lead and helical angle. The cutter is indexed by means of the plunger and index plate at the left of the arbor, any factor of ten, twelve, fourteen or sixteen being obtainable by means of the indexing device. A rest to support the tooth from the back is not used.

The wheelhead is mounted on an angular raising block, giving the wheel spindle an angle of 15 deg. from the horizontal center line. The front face of the wheel is dressed vertically, the diamond being clamped to the table for this purpose and the vertical feed being used. A single line of contact between the wheel and the work is thus obtainable, and the work can be fed vertically onto the wheel to the entire depth of the tooth.

The knee is swiveled on the stump to an angle corresponding to the helix angle of the cutter, and the table is reciprocated past the wheel by the regular rack and pinion movement, the work being rotated in the meantime at the proper relation to the lead and helical angle. The grinding plane is always on a true radial line of the cutter, and the wheel clears itself in the work.



LE BLOND ATTACHMENT FOR GRINDING CURVEX CUTTERS

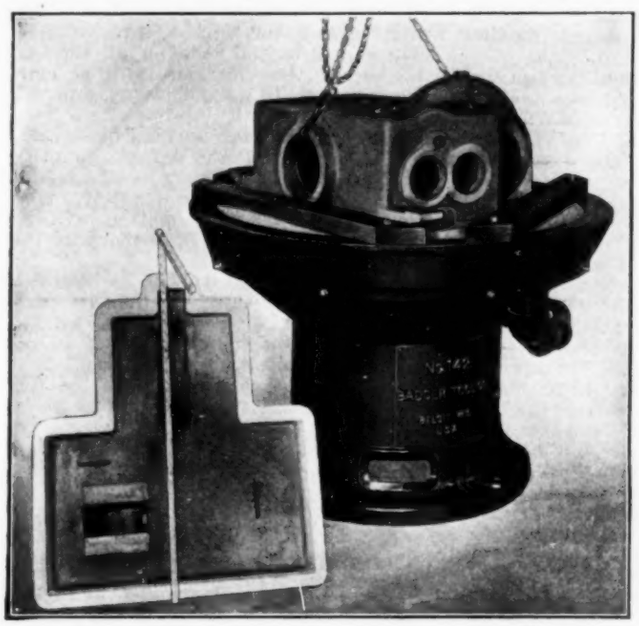
For the grinding of helically grooved hobs, the angular raising block and the belt sheaves are not required. The work-holding parts of the device can be furnished, however, for this purpose. The weight of the attachment for hobs only is 90 lb., while that of the complete attachment is 110 pounds.

Badger Vertical Spindle Disk-Grinding Machine

The illustration shows the No. 142 vertical spindle disk-grinding machine recently placed on the market by the Badger Tool Co., Beloit, Wis. The steel disk wheel is 42 in. in diameter and is faced with a layer of abrasive material ½ in. thick which is molded directly upon it.

Direct drive is secured by using the motor shaft as the wheel spindle. The end yokes are designed to be dust proof and very rigid, and positive forced-feed lubrication is supplied to both the radial and thrust ball bearings. A circular dust channel completely surrounding the wheel periphery terminates in two openings to which the dust exhaust system is attached. The dust channel can be entirely exposed by removing the guard ring which forms the outside wall. The open construction makes it possible for more than one operator to work at the machine at a time. The large transmission case and cover shown give an idea of the type of work that can be taken care of.

The No. 142 grinding machine complete with one



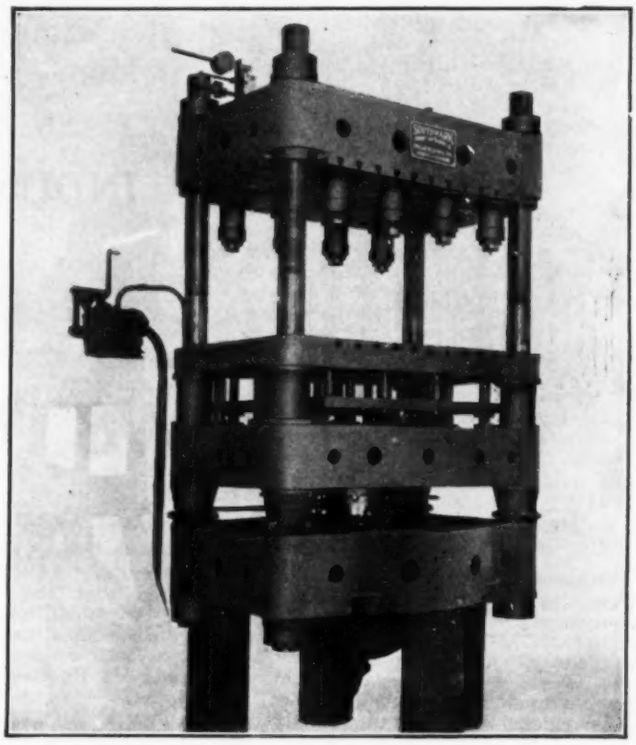
BADGER NO. 142 VERTICAL-SPINDLE DISK-GRINDING MACHINE

disk wheel weighs 3,800 lb. A 20-hp. motor running at 600 r.p.m. is used and stop bars as shown are provided to prevent the work from rotating with the wheel.

Southwark Automobile-Body Press

The Southwark Foundry and Machine Co., Philadelphia, Pa., has recently developed the all-steel hydraulic press shown in the accompanying illustration, particularly for use in the manufacture of automobile bodies. The press has a capacity of 450 tons. The main ram is located in the lower base, to which are secured the four columns. One clamping platen and one stripper platen are provided.

The stripper platen carries four hydraulic cylinders, which act upon a forged steel plate, which in turn carries sixty stripper pins 1¼ in. in diameter and projecting through the clamping platen. The clamping



SOUTHWARK AUTOMOBILE-BODY PRESS

platen itself is a solid steel casting, and is provided with T-slots. The top platen carries eight hydraulic jacks used for clamping, each having a 5-in. ram and 5-in. stroke. The position of the top platen is adjustable, so as to suit various sizes of dies.

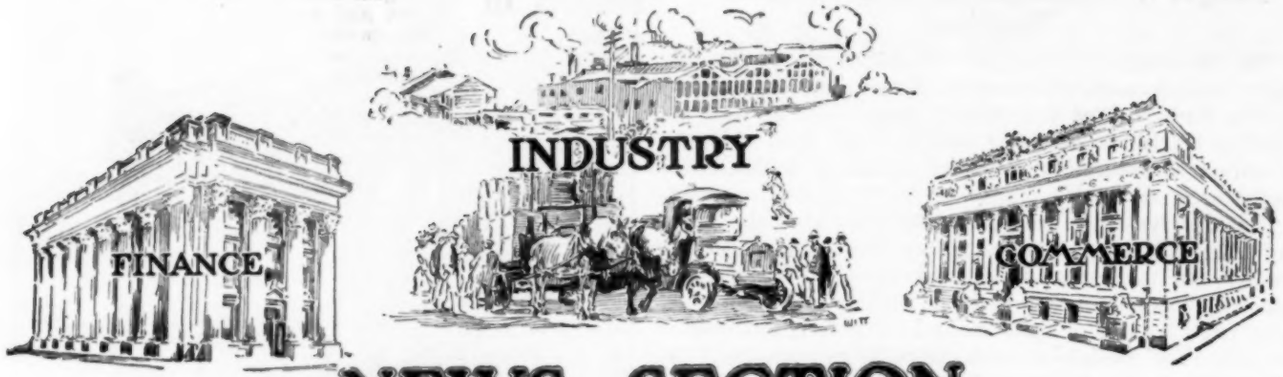
The press is controlled by a single-lever operating valve, which first admits low pressure to the four jack cylinders and at the same time low pressure to the main ram. As soon as the dies come together, high pressure is admitted through the steel operating valve, thus forming the work to whatever shape is given it by the dies. The clamping cylinders are controlled automatically from the low-pressure filling tank, and are capable of standing an hydraulic pressure of 5,000 lb. per square inch. The press has a die space of 7 x 5 ft., and the vertical opening between the platens is 18 in. as a minimum and 4 ft. as a maximum.

Canada To Build Railroad

The Ontario government has decided to extend the Temiskaming & Northern Railway northward about 70 miles toward its final terminus at tidewater on James Bay. This extension will involve an expenditure of about $3,500,000, and it is planned to award the work as a single contract which will provide work for the unemployed of this region.

Bids for the construction of this extension will be received by the Temiskaming & Northern Ontario Railway commission, and the data required for submitting bids have been ready since Dec. 1.

The above is from a report submitted by vice-consul J. H. Wetmore, North Bay, Ontario, who will see that the bid requirements are furnished, as soon as prepared, to any responsible contracting firm requesting them. The vice-consul at North Bay will also arrange to deliver to the commissioners any and all bids sent in his care.



NEWS SECTION

Penn R. R. Buys Harley Cycle Plant

Arrangements were completed last week for the sale of the plant and equipment of the Harley Company, manufacturers of motorcycles and parts, to Pennsylvania Railroad interests.

It is understood that the plant will be operated by a subsidiary of the Pennsylvania system and possibly continuing the old name of Harley Company. It is further stated that a variety of parts and accessories will be made there for the railroad, and that the project calls for the erection of large additional shops next summer. The site occupied by the plant covers forty-two acres, of which the present buildings utilize less than one-tenth. This move by the Pennsylvania is regarded as pointing to a largely increased interest on the Pennsylvania's part in New England affairs, with virtual absorption of the New Haven system foreshadowed, unless some new developments should interfere with the present trend. Hitherto the Hendee Manufacturing Co. has controlled the Harley Company, owning most of the common and preferred stock.

British Produce Nine-Cylinder Airplane Motor

The Bristol Airplane Co., of Bristol, England, the oldest established concern of this kind in the United Kingdom, has developed a nine-cylinder engine, known as the "Jupiter," which has been tested recently by the British Air Ministry. The test has shown very favorable results. A description of the engine and a "Digest of the Bristol Jupiter-Type test report" have been received from Consul Robertson Honey, and are on file in the Automotive Division of the Bureau of Foreign and Domestic Commerce, whence they may be obtained on request for Exhibit No. 41299.

Car Loadings Drop

Loading of revenue freight during the week which ended on Dec. 17 totaled 727,003 cars compared with 742,926 the previous week, or a reduction of 15,923 cars, according to reports filed by the railroads of the United States with the car service division of the American Railway Association. This was a reduction of 75,268 cars compared with the corresponding week last year and 79,731 cars, compared with the corresponding week in 1919.

War Department Adopts A.E.S.C. Specifications

Secretary of War Weeks has directed that the supply branches of the Army utilize in connection with their specifications the standards that have been or may be adopted by the American Engineering Standards Committee.

This is part of a general policy of the War Department to co-ordinate its whole supply system with the best commercial practice, and to support a national program of the engineering and industrial standardization, according to Colonel George S. Gibbs, of the General Staff.

The essential needs of defense are men and supplies, or personnel and material. The men must be trained and have the will to win. The supplies must be suitable for their uses and adequate in quantity. That is where standardization comes it. It represents the difference on the one hand, between being able to get the needed quantities of uniform articles of tested usability, and on the other hand, of being restricted and harrassed by a hodge-podge of varieties, the usable quantities of which are always insufficient.

The importance of standardization of war supplies cannot be exaggerated. In these days war involves the united effort of an entire nation and the combined employment of all of its principal industries. How is it possible to harmonize the use of thousands of articles to a common end except by the adoption of a far-reaching and effective program of standardization?

There are seven supply branches of the Army—the Quartermaster Corps, which purchases all general supplies of a commercial character, Ordnance Department, Medical Department, Corps of Engineers, Signal Corps, Chemical Warfare Service and Air Service.

Molding Sand Research

The Bureau of Standards of the Department of Commerce has been invited to take an active part in organizing and executing a comprehensive series of investigations relating to the properties, testing, and standardization of molding sands. The bureau has done considerable work on this subject in the past, and it is to be expected that with the active co-operation of the American Foundrymen's Association, the National Research Council, and others, considerable progress will be made in this important subject which has hitherto been in a very unsatisfactory condition.

Sale of Machinists' Dividers by Navy

The Navy offers for sale approximately 3,810 machinists' dividers, in sizes and quantities. Inspection of this material which may be seen at points of stock locations is invited. No samples, however, will be furnished free of cost. Informal bids on all or any number of these dividers will be considered up to 10 a.m., Tuesday, Jan. 10.

In the event of two or more bids being equal, but for unequal quantities, the bid covering the larger quantity will be given preference. In case of equal bids on the entire quantity, or on equal quantities, the matter will be decided by lot or by agreement of the bidders.

Successful bidders will be notified promptly and award will then be made after receipt of deposit by certified check or postal money order, of 10 per cent of the total amount offered. Bids in order to be considered must be forwarded to and received at the Board of Survey, Appraisal and Sale, Navy Yard, Washington, D. C., on or before the time stated above and marked "Informal offer on Machinists' Dividers."

Holiday Greetings Received

The *American Machinist* gratefully acknowledges the receipt of the season's greetings from the following:

Queen City Machine Tool Co., Auburn Ball Bearing Co., Bound Brook Oil-Less Bearing Co., Standard Engineering Works, Arva Stroud, Woodward & Powell, Barnes Drill Co., Bloomquist-Eck Machine Co., The Norma Company of America, Allied Machinery Company of America, E. C. Atkins & Co., Inc., Detroit Twist Drill Co., Moltrup Steel Products Co., Kempsmith Manufacturing Co., National Lead Co., and the Associated Business Papers, Inc.

Edison Medal for C. C. Chesney

The Edison medal for meritorious service in electrical science engineering or art for 1921 has been awarded to Cummings C. Chesney, general manager of the Pittsfield Works of the General Electric Co. Former winners have been Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander G. Bell, Nikola Tesla, John J. Carty, B. G. Lamma, W. L. R. Emmet and Michael G. Pupin.

Huge Stocks and Exchange Cause Stagnation in British Market for American Machine Tools

The trade information committee of the American Chamber of Commerce in London has issued a special review of the conditions prevailing in Great Britain for American machine tools. Some interesting facts are disclosed and suggestions are offered for the American manufacture to think over.

American machine tools enjoyed a good market in Great Britain before the war, particularly in the heavy types. But due to the huge stocks held both by the Government and by dealers, to the war time expansion of the domestic machine tool industry, and to the handicap of exchange, the present condition is one of stagnation, and it is considered doubtful having regard to the expanded facilities of the domestic manufacturers whether the market for American tools will ever again be what it was.

The heavy types always sold well in pre-war days owing to the fact that the American manufacturer backed by a big home market was able to produce in large quantities and thus sell on favorable terms.

In 1909, 84 per cent of the total British imports of machine tools were from the United States. In 1911 this per centage had increased to 93, and in 1915 to 99. In 1918 it had slightly decreased to 98 per cent. Now, not only are British imports of machine tools as a whole much lower, but the percentage brought in from the United States has again decreased.

During the first ten months of 1920 British imports of machine tools were 11,718 tons, whereas during the same period this year they have fallen to 2,704 tons.

As mentioned above it is regarded as extremely doubtful whether American tools will ever again be in such demand in Great Britain. In any case it is certain that competition between British and American machine tools will be much keener in the future.

The war has caused a revolution in the British machine tool industry. Great expansion has been made and more up-to-date methods are being used. Manufacturers have increased their capacity of production both in quantity and quality and are likely to be less dependent on American tools in the future.

During the war the British government was compelled to help manufacturers in order to get the kind of machine tools it wanted. It also imported large quantities from America, and British manufacturers copied the designs and manufactured for war purposes.

This experience has led to the development of the British machine tool industry to an extent formerly undreamed of, with the result that Great Britain will be more self-supporting in the future.

Handicap of Exchange

At present American machine tools, in common with most American goods in Great Britain, are greatly handicapped by the rate of exchange. German tools are coming on the British market in increasing quantities helped, of course, by the depreciated state of the mark.

One manufacturer stated that he was offered a choice of three machine tools of similar design, one American, one British and the other German. The price of the American and the British was practically the same, roughly about £1,000, while the German, very slightly inferior, was only £275.

Many American importers state that neither American or British manufacturers can hope to compete with German machine tools in the present state of the exchange.

It is reported that German manufacturers have made quite good copies of American models and are able to sell them in Great Britain at roughly one quarter of the cost of American tools. Although these are not so good as British and American machine tools, they are said to be of fair quality and to be reliable. In any case it cannot be said that because British and American tools are four times the price they are also four times as good.

It is believed, however, that German competition will be most severely felt on the Continent. This is borne out by official returns for 1920, which show that German machine tools were exported to the value of 1,324,093,000 marks, the metric weight being approximately 949,212 quintals (a quintal is 220.46 lb.). Of this quantity 190,000 quintals went to Holland, 130,000 quintals to France and 120,000 quintals to Switzerland.

Stocks Held by Government

There is undoubtedly a great deal of fear in the minds of manufacturers and importers as to the large stocks still held by the Government. One American importer of machine tools states that he does not think these stocks are so large or in such good condition as to constitute a really serious factor. On the other hand the majority of British manufacturers and American importers agree that the stocks in the hands of the Government are not only large, but consist of much valuable material which will take some years to absorb.

It should be remembered too that many firms have bought large quantities of machine tools from government stocks, and also from dumps abroad at very low prices, in the hopes of selling them at higher prices. But so far these hopes have not materialized, prices realized being usually so low that the goods have been withdrawn from sale.

The stocks held by the Disposals Board are valued at between 1½ and 2 millions sterling, which is exclusive of the stocks in the hands of other dealers.

Ridiculous prices are being offered for machine tools at various sales which have taken place. For example at a recent sale at Coventry American milling machines normally selling at £115 were *sold* for £5.

It is rumored that the Disposals Board has been approached by British manufacturers and asked not to unload its stocks in the present state of trade, as it would only have the effect of closing down the few firms still working.

Among the large quantity of machine tools advertised for sale by the Disposals Board are lathes of all kinds, milling, grinding, drilling, profiling, planing, screw-cutting, shaping, slotting, boring, cold-sawing, engraving and gear-cutting machines of both British and American manufacture.

At present the British machine tool trade is practically dead or, as recently described in the House of Commons, in a state of "paralysis." Very few firms are working full time, many are working short time, and a good number are closed down altogether.

It is true that a small amount of business is still being done chiefly for railways where replacements are absolutely necessary, and in the lighter and less expensive makes of machine tools, but practically all business is in replacements.

British manufacturers have always had good markets for machine tools in India and Japan and are still doing a fair amount of business there and also on the Continent, chiefly in the devastated regions. It is reported, however, that Japan is now beginning to manufacture machine tools to a much greater extent than formerly and is endeavoring to become independent of imports.

During the first ten months of 1913 British exports of machine tools were 13,464 tons; in 1920 they were 18,438 tons, and for the same period in 1921 they were 18,055 tons, which is much higher than in 1913 and practically as high as in 1920. The 1921 exports are understood to consist mainly of Indian orders which could not be executed in the early part of 1920.

British manufacturers are hoping that the Government Trade Facilities bill, by opening up and expanding various industries, will increase the demand for machine tools and so result in increased business.

Although at present there is no market in Great Britain for American machine tools, some hints as to entering the market may be useful for future use. The best way, and practically the only successful way, is undoubtedly to open up a branch in Great Britain, put it in charge of an American who thoroughly understands his business—but employ British salesmen who understand British prejudices and methods.

Agencies of various kinds have been tried in the past, but are regarded generally as not having proved so successful as a branch house. Prominent American firms who are already well established in Great Britain are all agreed that nothing gives such all round satisfaction.

Chamber Can Help

In conclusion, it can be said that until the exchange becomes more favorable to business very little will be done in the way of selling American machine tools in Great Britain. Another element in the situation is the fact that many British firms which expanded largely during the war are now running only about 25 per cent of their capacity.

What the future for American machine tools will be cannot be predicted. Opinions are divided on the subject. Some American importers state that there will be a good market once trade conditions are more normal, but others think that American tools will no longer enjoy the free field they formerly did, and that there will be bitter competition.

American manufacturers proposing to enter the British market seriously and permanently are advised to take up the question with the American Chamber of Commerce in London.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The detachment of the United States from the economic involvements of Europe is shown by the fact that the suspension of the Banca Italiana di Sconto had hardly any effect here, except as it compelled the Italian Discount and Trust Co., of New York, to close its doors pending definite news from the Banca di Sconto with which in the course of its business it had accumulated a large credit. The deposits of the New York concern are about $12,000,000 and those of the Italian bank stood at 3,538,745,327 lire, according to its statement of May last. Its paid up capital was 315,000,000 lire and it had a reserve of 68,000,000 lire. Marconi, of "wireless" fame, was its president and it had 150 Italian branches and offices in Paris, Marseilles, Barcelona, Constantinople, Tiflis, Tunis, Massowah, Rio de Janeiro, Santos, Sao Paulo and many other foreign cities. The Italian government has declared a moratorium applicable only to the debts of the Banca di Sconto. It is not as was at first reported a moratorium which applies to all debts due in Italy and its purpose appears to have been to camouflage the bank's embarrassment by legalizing its suspension.

The affair would seem to resolve itself into a highly speculative episode, but as (calculating the lire even at its presently depreciated value of 4.30 cents) the liabilities involved exceed $160,000,000, it is not to be lightly regarded.

Every one realizes that at some time not far distant the fool's paradise of paper money in which Europe is now living will be wiped out and we shall be fortunate indeed if no repercussion of its collapse is felt in this country. The French national debt which is now about 328 billion francs stood at about 28 billion francs before the war, and has been increased by 146 billion francs since the armistice. The German bank statement of Dec. 22 shows a further increase of about 6 billions in the paper marks outstanding, the total being now 109 billion. Austria has trillions of paper crowns in circulation that are almost worthless, and in Russia the situation is even worse for the Soviet government admits having issued 11,152,000,000,000 paper rubles in the last four years.

Deflation Must Come

To hope that this mass of paper obligations can ever be redeemed at their theoretical value in gold is fatuous and foolish. Sooner or later they must be scaled down or formally repudiated and it remains to be seen what the result will be in this country. The best opinion is that since it is generally realized here that many European governments are practically bankrupt a confession of insolvency is discounted and the effect will be negligible.

But it is just as well that we should not be over confident for it is quite possible that European deflation, when it comes, will develop sporadic cases of financial weakness here similar to the suspension of the Italian Discount and Trust Co. in New York.

By being prepared for such occurrences we shall protect ourselves, and this word of caution is written because the attitude of France in refusing to accede to the proposals made at Washington for limiting the construction of submarines and auxiliary vessels, is creating a somewhat difficult situation when taken in conjunction with Germany's announcements that she cannot and will not make any further reparation payments after meeting the installment due on Jan. 15. She claims to have paid the equivalent of 200 billion gold marks, equal to 47,000,600,000 gold dollars during the year 1921 and insists that this is all she can do for the present. The total of the payments chronicled in the American newspapers is, however, much less than the sum mentioned.

The spread of Ghandi's "non cooperative" movement in India, a serious uprising of the natives in Egypt that the English had to suppress by the use of arms, an anarchistic outbreak in Portugal, and Lenine's boast that the Russian "Red" army of 1,500,000 men will be largely increased by next summer that it may contest with the "Imperialistic Entente" for the domination of the Eastern world complete the transatlantic picture, which has for its gruesome background the story that the starving peasants in the valley of the Volga have become cannibals and are eating the flesh of their companions as they die.

The Bright Side

Turning from this gloomy portrayal which, I repeat, is exhibited only in a spirit of caution, it is pleasant to contemplate the cheerfulness which appears to be felt on this side of the Atlantic. The holiday sales are said to have been even larger than was expected last week but no precise figures are as yet available. Railroad net earnings for November are also better than had been anticipated. It is estimated that they will be at the rate of 4 per cent upon the valuation of $18,900,000,000 that the Interstate Commerce Commission has put upon the roads, whose market value as indicated by the prices at which their securities are selling is less than $12,000,000,000.

Logically these figures would indicate an advance in railway securities were it not that the gain in net revenue is mainly due to a reduction in operating expenses. Gross earnings are still poor. They are not likely to improve until rates are reduced and the traffic movement is thereby stimulated. The public are meantime protesting, the motor trucks are capturing much of the short haul freight the railroads formerly carried, and Mr. Walker D. Hines, formerly director general of the United States Railroad Administration has made a speech predicting a compulsory unification of the railroads because the public will be unwilling to pay the cost of maintaining so many different systems.

In the commodity markets the only important change in value is a decline in sugar. Refined granulated has sold at 4.80 cents and Cuban Raw at 1.75 cents, cost and freight New York. These prices which are the result of Cuban liquidation are nearly the lowest on record and will no doubt lead to an early distribution of the well advertised surplus. They should and probably will attract investment buying.

A Boston report says that "in all the markets of the world the price of wool is rising." The reason seems to be that the British Australian Wool Realization Association has the market well in hand and that there is a possibility of under production in the future.

Cotton has been very steady with a rising tendency as the time for planting next year's crop approaches. If the world should conclude that we are not likely to make more than 8,500,000 bales in 1922, extreme prices might be seen. Henry Hentz & Co., well known authorities on the subject, estimate the production of refined cotton oil for the current season at 2,050,807 barrels of 53 gallons each, as against the previous season's production of 2,927,673 barrels. It is to be inferred that they regard present prices as reasonable considering the reduced supply.

Future Looks Good

The reports from the steel industry are distinctly optimistic but they appear to reflect a hope of future business rather than present activity. Copper is steady at 14 cents for January delivery. Coffee has maintained most of the recent advance and those who think they have knowledge of the plans of the Brazilian government expect much higher prices soon after the first of the year.

The reserve ratio of the Federal Reserve system has risen from 70.7 to 71.1 per cent during the week. The gold held shows a loss of $1,400,000. The money market is unchanged but in some quarters a further reduction in the rediscount rate is expected next week. The bond market has been quieter. Recent offerings are not fully digested yet but prices are not quotably lower. The stock market has been dull but the stolidity shown in the face of the Italian news has been very impressive and there are many who predict activity and rising prices early in the new year.

The steadiness of foreign exchange is also impressive for there is but little change in quotations. Italian lire declined to 4.19¼ on the bank suspension but quickly recovered most of the drop.

Summarizing the situation it may be said that the barometer seems set for fair weather in the United States, unless the European area of low pressure shall extend itself westward across the Atlantic, and that the most reassuring development of the week has been our apparent insensibility to the economic unsettlement abroad.

Sidelights on Metric Hearings—Senator McNary Against Compulsion

After listening to much testimony, pro and con, on the Ladd metric system bill, Senator McNary of Oregon, who is conducting the hearing, revealed some of his personal conclusions, during the session on Dec. 23. At one point in the hearing he said:

"The element of compulsion is the most important element in the whole scheme—the setting arbitrarily of a certain period of time, of telling the American people they will have to change about on this subject, to face about on a matter that is in everyday use. That does not coincide with the temper of the American people as I have seen it manifested. That element to my mind is one of the most serious things in the bill."

This comment came during the testimony of Justin W. McEachren, editor of the *Valve World*, who appeared to present his own views and those of the president of the Crane Company. Mr. McEachren declared that the Crane Company is interested in the metric bill, not only as a manufacturer but as a distributor. He stated that the company has sixty-five branch houses in the United States, in addition to the maintenance of extended activities abroad. "Through this widespread organization," said Mr. McEachren, "we have made a study of the trade field, both domestic and foreign. We are here as supporters of this measure as a result of our experience. We do not believe the expense involved in a change to the metric system would be great. Even if it should be proposed to make the international decimal system the sole system of weights and measures for the United States and for the world, and the expense of such a change should be considerable, the Crane Company is quite willing and ready to make the change in company with the other manufacturers of the United States. The bill as it stands is acceptable to the Crane Company."

When Mr. McEachren referred to the necessity of looking at this matter in an international way and declared that "we are getting ready for a world condition, not a local condition," Senator McNary said:

"That is what some thought a year ago when we had the League of Nations up. I notice the American people are still holding to the American view, not to the international view, as may be judged from the votes that were cast. The lack of the enforced use of the metric system in this country is not stopping one pound of exports, in my judgment. In my opinion this system would not bring about the sale of another pound of hops, another bale of cloth, or another pair of shoes.

"I believe in the system but the question with me is how are we going to fasten it on the public. I am inclined to believe that it will not be by compulsory action, in ten years in any event. If the present system is impeding our foreign commerce, I think the law of economics would apply to bring about a voluntary change. When I find that the tool I am using is not as effective or as efficient as another, I discard it and take up the new one. I do not need legislation to compel me to do it. If the commercial interests of our country are suffering, why do not the interests that make use of this system take it up and adopt it among themselves so that they may be able to expand their foreign trade, as you say? Why force it on someone, or some class who will derive no benefit at all from it? In that category is the great mass of the people."

At another point in his testimony Mr. McEachren said:

"In our Chicago shops Crane Company employs 7,000 men. Out of that number there are not more than 300 who handle tools of precision, or who would have to be concerned with the system of measurement. These few selected, trained and skilled workmen make the tools, gages, templets and jigs. All the man knows who represents the larger mass is that there is a 'go' or a 'no go' gage. The man who is operating the machine knows only that about it. We can change the gage as often as we like. All the men have to do is to say that it goes on or it does not go on. There will be no scrapping. Gradually the manufacturer in his replacements will change his gages, and when sizes are changed they will be changed to the international or national agreement."

Germany Must Seek Export Market for Automobiles

In Germany the automobile industry has lately taken a prominent place among those industries of the country dependent to a very high degree on the export of their products, according to a report by Howard W. Adams, representative of the Commerce Department at Berlin. This situation has been brought about by the extremely restricted domestic market, which in turn is due to the soaring domestic prices of automobiles, the high cost of maintenance, and the heavy burden of taxation which is threatening automobile traffic in this country.

About 150,000 employees are engaged in Germany's automobile and allied industries. The automobile plants, which were considerably enlarged during the war, represent an investment of many millions of marks. This investment would be lost, in part, were not the continued operation of these plants assured; and that assurance appears to lie in a large scale expansion of Germany's automobile export trade.

According to figures published by the Federal Bureau of Statistics, Germany exported during 1920 a total of 17,534 automobiles and 3,541 motorcycles. This total export of motor vehicles in no way represents cars manufactured in 1920. In it is included a considerable number of used automobiles, for the most part former army automobiles.

It is interesting to note the proportion of the total representing export by the industry itself and that part representing export by automobile dealers. Figures published by the Association of German Automobile Manufacturers show that the manufacturers themselves exported about 8,000 motor vehicles. Leaving out of consideration the very insignificant number of those occasional exporters not falling within the category of dealers, the number of cars exported by the automobile trade can be said to have attained a total of about 9,500.

Southern Industries Look for Big Business in 1922

While 1921 is regarded as being a very slow year for industry in the Southern field, the outlook for the future is many times better than it wrs at this period one year ago. Southern industry turns its eyes toward 1922 with every confidence that the early part of the new year will witness a full return to normal conditions.

The greatest improvement experienced by any of the southern industries during the last three months of 1921, was in the metal trades, including foundries, machine shops, blast furnaces and iron and steel plants of every description. The greatest activity is noted in the cast-iron pipe, sanitary pipe and fittings plants, radiator plants and structural steel. In the Alabama district improvement has been more rapid than in any of the other Southern states, but the outlook is bright for increased activity in the metal trades plants of Georgia, Tennessee and North Carolina.

Export business from South Atlantic and Gulf Coast ports has improved to some extent in the past two or three months, but the business is still well below normal. There are excellent prospects, however, for much greater activity after the first of the year. So far as the products of the foundries and machine shops are concerned the biggest demand is expected from South and Central American countries, Mexico, Cuba, China, and Japan. Considerable sugar machinery will be taken by Cuba next year, coming mainly from the plants of the Birmingham district, while Argentina is expected to take considerable high pressure cast-iron pipe. A large amount of pipe will also be taken by cities along the Pacific coast, shipped by way of Mobile and the Panama canal. Principal demand from South and Central America and from Mexico will probably be for wire and wire products, while considerable tonnage of steel rails will go to Japan and China.

Georgia Taxes Lower

Tax values of foundries and machine shops in Georgia for the present year, as compared with 1920, show a reduction of 42 per cent, which aggregates $1,185,451, according to the State tax department. A decrease also is shown in textile plants, mining properties, mineral leases, and other important industries. Products manufactured by Georgia foundries and machine shops in 1920 were of an aggregate value of $33,480,955.56.

P. & W. Xmas Party

The publicity and engineering forces of the Pratt & Whitney Co., had a real honest-to-goodness Christmas party at the office of the company in Hartford on Dec. 23. Santa Claus, who, except for his snowy locks and flowing white whiskers greatly resembled the genial Mr. Henry of the publicity bureau, arrived as per schedule with his little red sleigh (the latter looking much like one of the factory trucks), laden with gifts for everyone. Besides the presents there was considerable original Christmas literature of a somewhat personal nature that added to the merriment of the occasion.

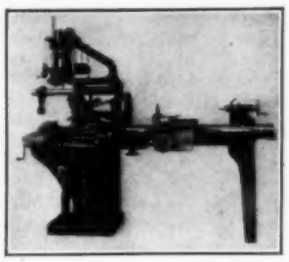
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Combination Machine, Lathe, Milling and Drilling Machine

Dalton Mfg. Co. Sound Beach, Conn.

"American Machinist," August 4, 1921.

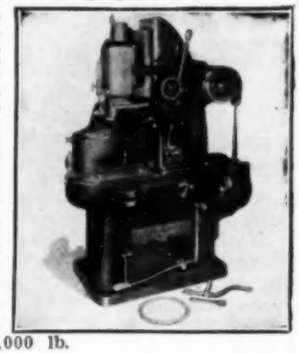


This combination machine is designed primarily for use where a rather complete equipment is required and floor space is at a premium. A single hollow spindle serves both the lathe and the milling machine. The lathe swings 18 in. over the shears, and will take 37 in. between the centers. The head has a three-step cone, and is provided with a single back gear, giving a speed range from 20 to 441 revolutions per minute. The milling machine table has a working surface of 24 by 7½ in., and a longitudinal feed of 15 in. The transverse movement is 6½ in., and the knee can be adjusted vertically 13¼ in. The machine will drill to the center of a 16-in. circle, and the spindle has a vertical travel of 9 in. Net weight, 2,000 lb.

Grinding Machine, Surface, Rotary-Table, 8-Inch

Pratt & Whitney Co., Hartford, Conn.

"American Machinist," August 4, 1921.

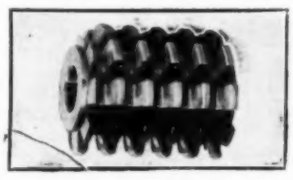


The machine is intended primarily for the grinding of disks, rings and cylinders requiring flat and parallel surfaces. Means are provided for grinding concave or convex surfaces. The spindle is mounted on ball bearings. The wheel is cemented in a holder screwed to the spindle, and a band clamped around the wheel guards against breakage. The wheel feed is controlled by a hand lever and a positive stop is provided for grinding to a specified thickness. The rotary magnetic chuck has two speeds. The machine is equipped with a pump, and the tank is located within the column. Belt drive is regularly furnished, all necessary guards being provided, but individual motor drive can be supplied. Net weight, 3,000 lb.

Hob, Generated, Simmons Method

Simmons Method-Hob Co., 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa.

"American Machinist," August 4, 1921.

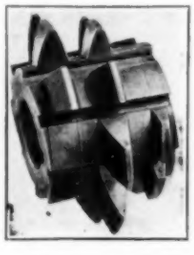


The hobs are claimed to be mechanically accurate, as they are produced by a generating action, a feature which makes it possible to duplicate them absolutely. The generating of the hobs is perfectly practical, the maker states, because the method follows "the law of the involute." No forms or templates are used to determine the tooth contour. Hobs for different forms of involute tooth, both standard and stub, can be furnished, the cutter being made to suit the requirements in such matters as pitch, pressure angle and number of threads. The importance of hardening is recognized, as a special method of hardening is said to be employed.

Hob, Worm

Gould & Eberhardt Co., Newark, N. J.

"American Machinist," August 4, 1921.



This hob has been developed for automatically hobbing worms. In the hob the fundamental principle is that of a broach coiled around a cylinder. The progressive removal of metal makes possible the use of heavy cuts and feeds. The hob can be used either to finish the teeth of worms, or for roughing them preparatory to final grinding. It can be furnished to cut worms with teeth of any desired contour. The hob teeth have their tops cut down in regular steps, and also have their sides recut to different leads. There are about fourteen roughing and three finishing teeth, which can be made either hooked or radial.

Lathe, Turret, Combination, No. 20.

Alfred Herbert, Ltd., Coventry, England and 50 Church Street, New York, N. Y.

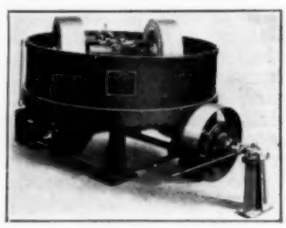
"American Machinist," August 4, 1921.

This larger size of machine has been added to the line of all-geared combination turret lathes. The machine is made with a hole through the spindle to accommodate stock 7 in. in diameter. The head-stock provides sixteen spindle speeds in each direction. All the shafts run on ball bearings, a ball thrust bearing being used for the spindle. The machine allows a swing of 28 in. over the bed. The maximum distance from the flange of the spindle to the face of the turret is 72½ in. The feed box under the headstock gives eighteen feeds to the turret slide. Nine feeds are provided for the saddle, which carries a square tool-holding turret. The main turret is horizontal, hexagonal in shape and is indexed manually.

Mixer, Sand, No. 3, Simpson

National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

"American Machinist," August 4, 1921.

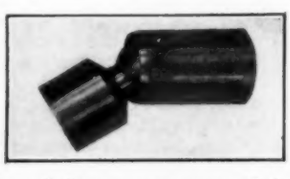


The mixer has a pan 8 ft. in diameter. The machine has been developed particularly for steel foundry purposes, but it can also be used where large capacities are required in gray iron, malleable iron, brass and aluminum foundries. It is claimed that the time for mixing is brought down to a minimum, because of the mixing action, which is done by a combination of plows and mullers. Most of the parts are made of cast steel. The machine is strongly built and intended to give continuous service with a low cost for maintenance.

Universal Joint, Screwless

Apex Machine Co., Dayton, Ohio.

"American Machinist," August 4, 1921.

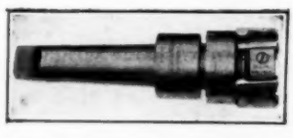


The joint is intended especially for use in driving the spindles of multiple-spindle drilling heads, although it can be adapted to all sorts of light and medium-duty drives. The maker claims that the device will fit all multiple-spindle drilling and tapping machines, and that it will drive with the shafts at angles of 35 deg., or in special cases on light drives at 45 degrees. The principal feature of the joint is its simplicity of construction, there being no screws used in it. The parts consist of one cup end, one ball end, one journal rocking pin, one driving pin, and one locking ring. The joint is made in all sizes from ¾ in. in diameter up to any required.

Toolholder, Floating

McCrosky Tool Corporation, Meadville, Pa.

"American Machinist," August 4, 1921.



The holder is intended for correcting for both angular and parallel mis-alignment of the machine spindle with the hole being machined, being adapted to use in drilling machines, boring mills, lathes and automatic screw machine for the driving of reamers, taps and counterbores. The holder is composed of three principal units, a driving member, an intermediate floating member and a driven member. In the center of the floating member is a hole in which is placed a hardened steel ball, taking the entire thrust of the cut and acting as a pivot. The holder is regularly made in three sizes and both the driving and driven members are made in different styles and sizes to suit the requirements of the work. It can be used either horizontally or vertically.

Clip, paste on 3 x 5-in. cards and file as desired

Trend of Business Improvement —Plants Resuming

The Willys-Overland Co., Toledo, Ohio, is taking on additional tool and die workers at its plant. The working force in other departments of the automobile works will be increased at an early date.

The American Car and Foundry Co., Jeffersonville, Ind., is planning for the resumption of operations at its local plant this month. A large repair order for the New York Central Railroad will be handled at the shops.

The Lebanon Iron and Steel Co., Lebanon, Pa., is making improvements at its plant at Duncannon, Pa., including machinery repairs, prior to the resumption of operations early in January.

The Franklin Manufacturing Co., Syracuse, N. Y., adopted a full time working schedule at its automobile manufacturing plant on Jan. 3, giving employment to about 3,000 men.

The Waltham Watch Co., Waltham, Mass., has resumed operations at its branch plant at Quincy, Mass., devoted for the most part to assembling work.

The Chicago Pneumatic Tool Co., Chicago, Ill., has advanced production gradually at its plants and is now operating at about 40 per cent of normal.

The Weatherly Foundry and Machine Co., Weatherly, Pa., has adopted a full time working schedule at its plant, following a curtailment under reduced operating basis for more than twelve months past.

The Hays Manufacturing Co., St. Louis, Mo., manufacturer of wheel hubs, etc., has resumed production at its plant at Timbo, near Calico Rock, Ark., after a four-months' shutdown. Present orders on hand insure continuous operations for at least three months to come.

The Southern Transportation Co., Chesapeake City, Md., is adding to the working force at its local shipyard and operations are being increased at the plant.

The National Transit Pump and Machine Co., Oil City, Pa., has increased its working force by about 200 men. An increased production schedule has been adopted at the plant.

The A. S. Hecker Co., Huntington, Ind., operating the car shops of the Erie Railroad under lease, has added to the working force and is now giving employment to about 125 men.

The Laconia Car Co., Boston, Mass., with plant at Laconia, N. H., has received an order from the Boston & Maine Railroad for the rebuilding and repair of freight cars, the contract totaling $1,000,000.

The Seabord Air Line Railway, Norfolk, Va., has inquiries out for 2,000 freight cars and will place orders for the equipment at an early date. The contract is expected to total close to $3,000,000.

The United States Steel Corporation, New York, has taken an order for 15,000 tons of rails from the Texas & Pacific Railroad.

The Urbana Tool and Die Co., Urbana, Ohio, is operating at full time with a complete force of workmen. The company is building tools for the production of a new model automobile.

The Bridgeport Manufacturers' Association, Bridgeport, Conn., recently announced a marked improvement in working hours for Bridgeport factories. According to figures gathered the average factory is now working 44.6 hours a week, or 91 per cent of normal, the highest weekly mark of the year. Figures from thirty-one plants show that 13,987 are employed, which is 54.8 per cent of normal. The number employed at the factories is much larger than that, however, as all the factories are not included in the tabulation. There is constantly increasing employment in the plants about the city.

Ordnance Department Must Have Aid of Manufacturers

With the passing of emergency, the Ordnance Department of the Army, which during the war was able to enlist close and hearty co-operation from manufacturers of ordnance material and mechanical engineers generally, is now finding it difficult to secure from private industry the assistance which is so necessary if the most practical types of ordnance material are produced. It is essential to the national interest that this apathy on the part of outside manufacturers be broken down, in the opinion of Brigadier General W. S. Peirce, assistant chief of Ordnance, in immediate charge of the work which involves this problem. He is at this time making a renewed effort to solve this problem.

The Ordnance Department must look largely to industry to criticise its designs from the point of view of ease and cheapness of production. Since most ordnance material has little or no parallel in articles manufactured for peace-time uses, its designs do not have the constant and wide study which is constantly being given the ordinary machinery and appurtenances of commerce. Moreover, ordnance material must be built with the idea of meeting the severest requirements. Every effort must be made to obviate a failure of material at the critical moment when there is no time to install spare parts or undertake repairs. As a result the physical quality of the metals used must be unusually high.

General Peirce believes that a widely held view that ordnance specifications are finical and too theoretical, can be offset entirely if machinery and material manufacturers can be interested sufficiently to go into the subject deep enough to understand the military problems involved. At any rate it is the policy of the Ordnance Department not only to invite suggestions from men engaged in practical manufacture, but to carry their suggestions into effect wherever it does not defeat a well-established military necessity. The Ordnance Department is particularly anxious to have the benefit of the advice of the private manufacturers. General Peirce states that ordnance officers realize that the study of designs from the point of view of shop production involves considerable expense on the part of manufacturers, in that they demand considerable time from the highest salaried men in their organizations; but he is hopeful that industry will contribute that much toward the national defense, and in turn he believes that manufacturers will find no inclination on the part of the department to insist on tolerances being smaller than necessary, quality higher than necessary, or features which tend unduly to interfere with the ease of manufacture or speed of production in time of urgent need.

Japan's Steel-Encouragement Act

H. A. Butts, acting commercial attaché at Tokio, has submitted the following translation from the "Official Gazette," of July 19, 1921, outlining the leading features of Japan's steel industry encouragement act, in which Japanese manufacturers of steel materials will participate:

The following amendment shall be made to the regulations relative to the application of the steel industry encouragement law.

Paragraph 3, article 5: The subsidy provided for in paragraph 2 or article 7 of the steel industry encouragement law shall be granted only in such cases as the following steel materials, manufactured after the present law has become effective, are used in the construction or repair of steel vessels by the manufacturer or the purchaser of the materials, and not including steel materials manufactured in foreign countries:

(1) Steel ingots and steel slabs for tempering.
(2) Bars and rods including tees, angles, and turbine blading.
(3) Sheets and plates.
(4) Tubes and pipes, not including those of cast iron and steel.

Manufacturers of steel materials mentioned in item 1 of the preceding clause are entitled to subsidy thereon as for raw materials, even if they sell them after improving.

Persons desiring to receive the subsidy shall submit to the Minister of Agriculture and Commerce a notification stating the kind, quantity, purpose, date of manufacture, and the factory in which the steel materials are manufactured before actual use if intended for shipbuilding or repairs and before delivery if intended for other uses. The notification shall be accompanied by a document certifying that the constructor or repairer of the vessels has obtained permission from the proper marine authorities in case the steel materials are to be used in the construction or repair of other than naval vessels. Any change made in the items stated in the notification shall immediately be reported to the Minister of Agriculture and Commerce.

Paragraph 4, article 5: Those persons desiring to receive the subsidy shall make application to the Minister of Agriculture and Commerce, accompanied by (1) a document certifying that the steel materials have been used by the naval authorities in the construction or repair of naval vessels or by (2) a document from the proper marine authorities certifying that the steel materials have been properly used and that the construction or repair of vessels upon which used has been completed, by the constructor or repairer of the vessels, when they have been used in the construction or repair of vessels not belonging to the Navy.

Paragraph 5, article 5: The amount of the subsidy shall be 12 per cent of the value for steel ingots and slabs and 15 per cent of the value for other steel materials. The value shall be determined by the Minister of Agriculture and Commerce by fixing the standard on the basis of the imported price of the same steel materials as those for use and delivery mentioned in clause 1 of paragraph 3 of article 5.

The amendment went into effect on July 20, 1921.

Allied Machinery Co. Elects Officers

At the annual meeting of the board of directors of the Allied Machinery Company of America, held in New York on Dec. 23, the following officers were elected for 1922:

J. W. Hook, president; I. T. Henry, vice-president; E. M. Hartridge, vice-president (in charge of European interests); T. G. Nee, vice-president (in charge of business in the Orient); W. H. Gilbert, treasurer; and G. C. Carson, secretary. The only new addition to this list is Mr. Gilbert, who takes the place of F. S. Pease, who resigned a few months ago to join the Eagle Silk Co. of Shanghai.

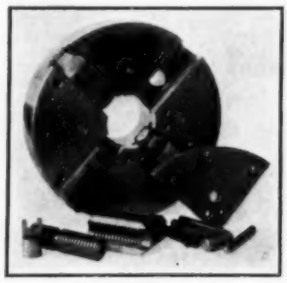
Directors chosen for the year are: J. W. Hook, M. C. Brush, J. E. Gardin, T. W. Streeter, H. A. Arthur, G. H. Balch.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

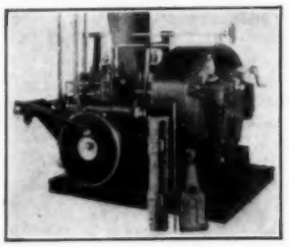
Chuck, Lathe, Independent, Four-Jaw
Alfred Herbert, Ltd., Coventry, England, and New York, N. Y.
"American Machinist," Aug. 4, 1921.

The chuck, having four independently operated jaws, is similar in principle and construction to the three-jaw chuck made by the concern, the strength and long life of the tool being the features emphasized by the maker. The body of the device is thick and heavily made, so as to prevent breakage due to excessive pressure at the jaws. The front of the chuck is made in the form of detachable sectors secured to the body by means of screws passing from the front to the back. The illustration shows one of the plates removed. The chuck can be furnished in a range of sizes.



Grinding Machine, Surface, Automatic
William Osterhom, 2301 N. Knox Ave., Chicago, Ill.
"American Machinist," Aug. 11, 1921.

The machine is intended for the rapid surfacing of parts up to 12 x 40 in. made in large quantities. It is fully automatic, with the exception of locating the work and locking it in the fixture. The fixture is mounted on a table pivoted on a swinging arm and moved across the surface of the abrasive wheel by means of a cam. Upon the completion of the cycle of the cam, the fixture is tilted back 45 deg. away from the wheel, allowing the operator to remove the work. The machine can be equipped with automatic magazine feed. A cylinder wheel, 20 in. in diameter, 8 in. thick and having a 10-in. hole, is used. Weight 7,800.

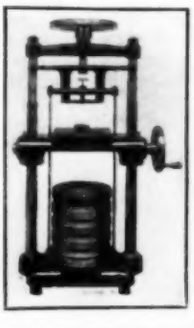


Testing Machine, Hardness, Power-Operated
Alfred Herbert, Ltd., Coventry, England and New York, N. Y.
"American Machinist," Aug. 11, 1921.

The machine operates on the Brinell principle, using a 10-mm. ball and employing the standard pressures of 500 or 3,000 kg., as required by the material being tested. The chief features of the machine are power operation and automatic application of the pressure. It is claimed that the time required to apply the load, the duration of the load, and the time taken to remove the load are uniform for all tests and do not depend on the operator and his physical effort. Apart from the main frame, which carries all the mechanism, the machine consists of two elements, a weighing element and a straightening element. Weight, 1,680 lb.

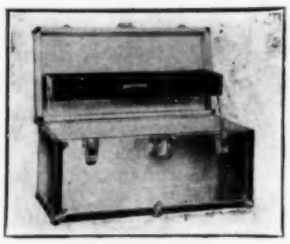
Testing Machine, Hardness, Small-Ball
Alfred Herbert, Ltd., Coventry, England and New York, N. Y.
"American Machinist," Aug. 11, 1921.

The machine is a development of the Brinell method of determining hardness, the difference being in the use of very small balls, with correspondingly small loads. It is intended for determining the hardness of thin specimens, such as the walls of small-arm cartridge cases, and of finished articles which cannot be subjected to the pressure of the ordinary hardness-testing machines, either because of their small size or because of the injury caused by making a large impression. The load is applied by dead weight. The balls used are 1 and 2 mm. in diameter, with loads up to 50 kg., although balls of 5-mm. diameter are supplied for testing extremely soft material. Weight, 210 lb.



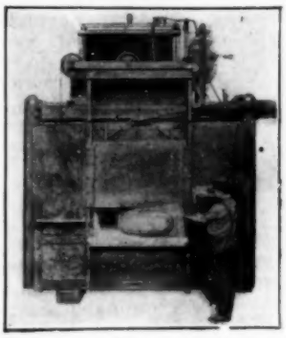
Tool Chest, Zinc-Covered
Union Tool Chest Co., Inc., Rochester, N. Y.
"American Machinist," Aug. 4, 1921.

The chests are made in a number of styles and intended for the use of machinists, patternmakers, carpenters, electricians, garage mechanics and the like. The illustration shows a general service chest, opening at the top, although side-opening chests can also be furnished. The frame of the chest is made of wood, a lock-corner being used for the joints. The outside is entirely covered with lacquered sheet zinc, which is formed over all of the edges. The chief advantage of the covering is said to be the fact that it will not rust nor corrode. The chest can be furnished in various sizes, either with or without trays, ranging in length from 13 to 32 in., and in weight from 5 to 21 lb.



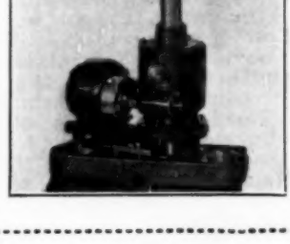
Furnace, Sheet-Heating, Electric, Bailey
Electric Furnace Co., Alliance, Ohio.
"American Machinist," Aug. 11, 1921.

This resistance-type electric furnace is intended for use in the heating of sheet metal when forming parts of automobile bodies and fenders. It is portable, being handled by a crane and taken from place to place as the work requires, so that it need not be idle while one batch of material is receiving its cold runs. The transformer and control equipment are located on the top of the furnace. The furnace is rated at 100 kw. in electrical capacity, and has a hearth 3 ft. 4 in. wide by 6 ft. 5 in. long, with a door opening 3 ft. 4 in. wide by 2 ft. 2 in. high. It has a capacity for heating 750 lb. of material to 1,800 deg. F. per hour.



Boring Tool, (Re-), Cylinder, Electric-Driven, Van Dresser
International Purchasing and Engineering Co., Inc., Detroit, Mich.
"American Machinist," Aug. 11, 1921.

The device, formerly intended for drive by hand or by means of a drill press, has been fitted with individual motor drive. The motor is mounted as a part of the tool, no flexible shaft being employed. A friction clutch is incorporated between the motor and the tool, so that slippage is possible in the event that the cutter head becomes wedged, thus protecting the motor. Without making any disconnections, the tool can be operated by hand or by the spindle of a drill press. The tool has a range of from 2¾ to 5 7/8 in. The solid feed bar has no threads, and the bearings are 10¼ in. long. The quick-return mechanism allows for raising the boring head.



Holder, Tap, Friction-Slip, Safety
Apex Machine Co., Dayton, Ohio.
"American Machinist," Aug. 11, 1921.

The principal feature of the device consists of the arrangement which permits of slippage within the holder itself in case the tap becomes wedged or strikes the bottom of the hole. Because of the small outside diameter of the device, use on multiple-spindle machines is quite easy. The holder will operate in any position. It is made in two sizes. Type A will tap holes up to ½ in., and type B holes from ¼ to ⅝ in. in diameter. The amount of friction may be quickly adjusted when changing from one size of tap to another. The holder embodies a 7/8-in. vertical float movement, to allow for a slight variation in the lead of the tap. There is also a lateral float of 1/16 inch.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Ladel Manufacturing Co. made its first casting this week in its new foundry and machine shop at New Philadelphia, Ohio. The operation marked the completion of a building operation started last June. The new addition encloses the largest and best equipped foundry and machine shop in eastern Ohio with a capacity for employment of 150 men. Two features of the plant are the powerful electric crane able to carry 15 tons from one part of the plant to the other, and the seventeen unit electric blowing machine. Edward Miller is superintendent of the new shop.

Plans are now under way for the operation of the foundry plant at the Freemans Ferry Landing, New Cumberland, W. Va. The new industry will be known as the Resistent Alloy Casting Co., incorporated under laws of Delaware with a capital stock of $10,000. The plant will produce gray iron and alloy castings.

The Stanley Dewsnap plant, Springfield, Mass., has been reorganized and will now be operated as the Highland Motor Grinding Co.

The Greenfield Grinding and Machine Co. has been organized in Greenfield, Mass., to make automobile parts and do general machine work. Machinery is being installed. Officers are: President, George W. Wilcox; vice-president, A. T. Ritchie; treasurer, R. F. Stearns.

After being closed for nearly a year, the car repair department of the Lake Erie & Western Railroad, at Lima, Ohio, was reopened this week, with a large force of men.

Control of the Carnahan Tinplate Corporation, of Canton, Ohio, has passed to the Falcon Tinplate Co., of Niles, Ohio. The combined organizations will continue to manufacture under the management of Lloyd Booth and Paul Wick.

The Exeter Machine Works, Inc., of West Pittston, Pa., announces the appointment of J. E. Holveck as district sales representative for the Exeter Rotary Pump line in the Pittsburgh district. Mr. Holveck was until recently connected with Crawford & Cameron of Pittsburgh, and was formerly designing engineer for the Aldrich Pump Co., of Allentown, Pa.

The Wilson Welder and Metals Co., Inc., of New York City, has moved its general office and factory to 132 King St., in that city.

The Surface Combustion Co., Inc., of New York, has been awarded the contract to build an automatic heat-treating furnace for the naval ordnance plant at South Charleston, W. Va. The furnace is for heating 16-in. armor piercing shells.

The Photostat Corporation of Providence, R. I., has announced the construction of an all metal photostat in all sizes and having a number of new features.

The Boston office of the Cutler-Hammer Manufacturing Co., has been removed to 403 and 404 Harvey Bldg., Chauncy., C. W. Yerger is in charge.

William H. Keller, Inc., is the new designation assumed by the Keller Pneumatic Tool Co., of Grand Haven, Mich.

The W. B. McCarthy Metal Co., Railroad Ave., Milford, Conn., manufacturer of metal goods, recently filed a final certificate of dissolution with the Secretary of the State of Connecticut.

The Sheehan Machine Co., Norwich, Conn., has recently filed a certificate of organization and incorporation with the Secretary of the State of Connecticut, to engage in the manufacture of textile machinery, etc. The incorporators are: J. F. Williams, T. P. Sheehan and Earl Matthewson, Thayer Building, Norwich, Conn.

The Thomaston Knife Co., Thomaston, Conn., recently filed a certificate with the Secretary of the State of Connecticut, increasing the company's capital stock from $20,000 to $75,000. The company manufactures knives of various kinds.

The Riverside Bronze and Aluminum Co., River St., New Haven, Conn., recently filed a certificate of incorporation with the Secretary of the State of Connecticut, to engage in the manufacture of aluminum and bronze articles. Thomas E. Hyde, of Bridgeport, Conn., is president; John F. Strong, New Haven, secretary; and Harold S. Brown, New Haven, treasurer.

The Bridgeport Machine and Tool Manufacturing Co., Inc., 304 East Washington Ave., Bridgeport, Conn., has filed an involuntary petition in bankruptcy. Arthur Klein, of Bridgeport, was appointed receiver.

Announcement of a wage reduction of 10 per cent for mechanical employees of the United States Armory in Springfield, Mass., was made last week. This action was taken following an inquiry into wages paid in other machine shops in that section. It is an average rather than a uniform reduction, the cuts varying with different lines of work. Plans are under consideration for temporary abandonment of the Armory's hill plant and concentration of operations at the Watershops. If this is done the hill shops will be used for storage. Present requirements call for a production of only seventy-five rifles a day, with a prospect of the number being reduced to fifty a day.

Judge D. C. Westenhaver in Federal Court at Cleveland, Ohio, has approved the sale of the Canton Drop Forge plant of the Standard Parts Co. to Fred A. Poor and Phillip Moore, of Chicago, at their offer of $293,500. In accordance with their proposal to the court, the purchasers will form a corporation with a capital stock of not less than $300,000. It is understood that the new company will operate the drop forge factory within the near future. All machinery not included in the sale is being removed to another part of the plant.

The property and assets of the Ashland Iron and Mining Co., at Ashland, Ky., has been purchased by the American Rolling Mill Co., of Middletown, Ohio. The deal represents an expenditure of about $5,000,000. The manufacturing plants at Ashland comprise two blast furnaces, eight open hearth furnaces—each of 100 ton capacity, an electrically driven blooming mill, a slab billet and bar mill, and six sheet mills.

The United Engineering and Foundry Co., of Canton, Ohio, has filed a complaint with the public utilities commission in Columbus, against the Pennsylvania Railroad, charging that rates on pig iron from Leetonia to Canton were excessive.

Announcement is made that the Cortland Steel and Tube Co., Cortland, Ohio, will begin operations immediately. The plant is said to be complete in detail. Officers of the new company are: President, B. G. McCurley; secretary and treasurer, Ben Spender; vice-president and general manager, L. A. Hansen.

ERRATUM: In our Dec. 15 issue we published a Business Item to the effect that the Whiting Corporation had combined with the Grindle Fuel Equipment Co., and that "a reorganization of the companies had been effected." We desire to correct this statement. The Whiting company has purchased a controlling interest in the Grindle company, but there has been no change in the organization of the Whiting Corporation.

Personals

C. F. ROGERS, formerly with C. E. Johansson, Inc., has joined the sales force of Purinton & Smith, Edwards St., Hartford, Conn.

A. H. BAUMAN has been elected vice-president of the Cleveland Duplex Machinery Co., Cleveland, Ohio. Mr. Bauman was formerly sales engineer of the company and was at one time an executive with the American Brake Shoe Works, Erie, Pa.

CHARLES G. SCHWARTZ, formerly a partner in Schwartz & Land, has organized the Acme Machinery Exchange, located at 196 Centre St., New York City.

WILLIAM S. DICKSON has been appointed assistant manager of the Crane Machinery Co., of Buffalo, N. Y. Mr. Dickson was formerly connected with the Cincinnati Planer Co. and Acme Machine Tool Co.

EARL B. STONE has been appointed advertising manager of the Cleveland Tractor Co., Cleveland, Ohio, manufactures of "Clectrac" tank-type tractors. Mr. Stone succeeds G. B. Sharpe, who has resigned.

E. T. VOGEL, superintendent of the byproduct plant of the Youngstown Sheet and Tube Co., Youngstown, Ohio, has been elected vice-president of the Eastern States Furnace and Coke Oven Association.

ARTHUR H. SONNEBORN has been placed in charge of the Chicago offices of the Osgood Company of Marion, Ohio, manufacturer of steam shovels and dredging machinery.

G. H. REHLING has been appointed district sales manager for the Wykoff Steel Co., Pittsburgh, Pa., with offices in Dayton, Ohio.

WALTER FERRIER has resigned his position with the Elyria Iron and Steel Co., Elyria, Ohio, to become general manager of the new Hudson City Steel Corporation, Beacon, N. Y. Mr. Ferrier

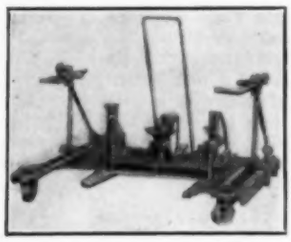
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Dolly, Truck-Wheel

Manley Manufacturing Co., York, Pa.

"American Machinist," August 11, 1921.



The dolly is intended both for conveying truck wheels and for raising or lowering them in a repair plant. It is mounted on ball-bearing casters, and provided with a handle by which it can be manipulated about the shop. The truck wheel is carried on two projecting forks, placed far enough apart to enable them to be put under a wheel standing on the floor. The forks have a vertical movement of 5 in., being operated by a crank. The device is particularly adapted to removing wheels from the spindle of the axle, or replacing them. Two adjustable arms are provided for holding the truck wheel from falling. Weight, 210 lb.

Watch, Time Study

Stein & Ellbogen Co., 31 North State St., Chicago, Ill.

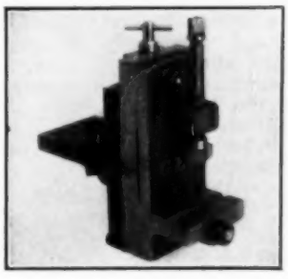
"American Machinist," August 11, 1921.

The double hands permit the timing of two closely related operations at the same time, or a comparative observation of two workmen or machines. In case of an interruption, the total time and the waste time entailed can be shown in figures of production as well as in decimals of a minute, thus simplifying computation. On the dial there are placed at intervals of 0.02 min., figures showing the rate of hourly production. Both hands are started by pushing down the crown. By pushing the button at the left of the crown, the under hand is stopped, while the upper one is allowed to travel as long as desired. In timing two workmen on the same kind of work, each hand shows the time taken by one workman.

Attachment, Milling, Lathe, "Gem"

Richard H. Kiddle's Machine Tool Works, Kinsman, Ohio.

"American Machinist," August 18, 1921.

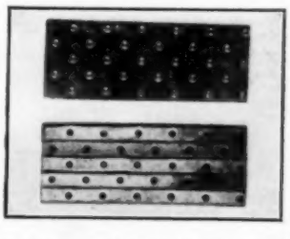


The device is intended for attachment to a lathe to hold the work while performing small milling operations. It is said to fit most lathes from 10 to 17 in. swing, the toolpost being removed and the attachment secured in its place. A tie bolt can be furnished to fasten the attachment to the cross-slide when it is used on the Gem lathe. The device has an adjustment to permit of moving it relative to the cutter. It is said to be capable of cutting keyways $\frac{7}{8}$ in. wide, and 7 in. long without re-setting. An arbor 12 in. long and made to hold a 1-in. B. and S. cutter is furnished.

Belting, "Pieuvre"

J. L. de Rabot, 191 Greenwich St., New York, N. Y.

"American Machinist," August 18, 1921.

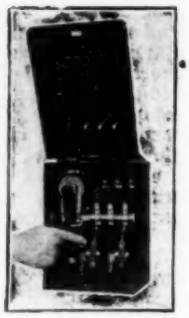


The chief claim made for the belting is its great power of adherence. The belt combines oak-tanned and chrome-tanned leathers, the oak-tanned leather taking the pull and the chrome-tanned giving the adherence. The belting consists of oak-tanned leather, to the under surface of which are attached narrow longitudinal strips of chrome leather, held by means of hollow brass rivets. The depressions surrounding the rivet ends, combined with the blind holes in the rivets, are said to act as suckers during use and to augment the adherence. The advantage which the high co-efficient of friction gives to the belt is that it can be run at a lower tension. Only tallow is used as a dressing.

Starter, Automatic, Squirrel-Cage Motor, No. 9604

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

"American Machinist," August 11, 1921.

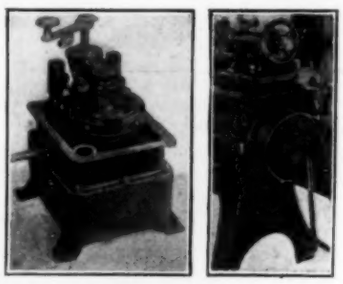


This starter is intended for use with small squirrel-cage motors of $7\frac{1}{2}$ hp. or less. It allows a large starting current for several seconds, but at the same time gives protection against burning-out and prevents harmful overloading of the motor. The two mercury overload relays mounted below the contact fingers are intended to eliminate fuse troubles, while allowing overloads as high as 25 per cent for a limited period. It is stated that considerable time is saved by using the automatic starter in place of a manually operated one.

Control, Feed, Variable, Liquid

Oilgear Co., Milwaukee, Wis.

"American Machinist," August 18, 1921.



The system is especially intended for the control and regulation of speeds, feeds and motions on machine tools, using liquid under pressure for the purpose. The variations can be made smoothly in steps of any desired size without stopping the machine. The device consists essentially of a power-driven pump, shown at the left of the illustration and capable of being adjusted through a large range of delivery capacity, and a motor driven by the working fluid received from the pump. The speed of delivery of the fluid can be varied by adjusting the length of stroke of the pump. The motor is shown attached to the lead screw of a lathe on the right. The pump can be connected directly to an hydraulic press.

Solder, "Metaloid"

Cochran Metaloid Co., Moffat Building, Detroit, Mich.

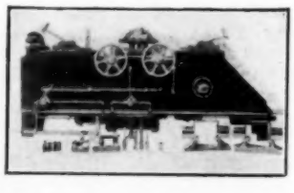
"American Machinist," August 18, 1921.

The material is intended for repairing holes and cracks in metal, and is especially for use in garages in repairing cracked cylinder heads, water jackets and transmission cases. It is stated that the metaloid will fluxate with any metal that can be heated, including aluminum, brass, and gray and malleable iron. The part to be repaired is heated to about 200 deg. F., usually with a blow torch. The metaloid is rubbed into the crack or hole, the parts allowed to cool, and the excess material filed off. The metal will, after solidifying, withstand a pressure of 250 lb. per sq. in. and a temperature of 600 deg., it is said.

Hose Machine, Repairing and Dismantling

Covington Machine Co., Covington, Va.

"American Machinist," August 18, 1921.



The machine is intended especially for use in railroad shops for work on air-brake, signal and steam hose, replacing hand methods of performing such work. It is claimed that the machine does not damage the fittings and clamps when assembling and dismantling. The work is said to be better than that performed by hand, and to be done at a great saving of time and labor. The illustration shows the entire equipment of tools required for performing the complete range of work. The change from any operation to another averages less than two minutes. Air and signal hose are handled by the same tools, except the nipple puller, which can be quickly put in place.

Clip, paste on 3 x 5-in. cards and file as desired

was with the Steel Corporation plants at Homestead, Pa., and Gary, Ind., for eighteen years, and later for seven years with the Cambria Steel Co., at Johnstown, Pa.

JOHN P. ILSLEY, formerly with Niles-Bement-Pond Company, Inc., New York City, has recently been made New England manager of the Solvay Process Co., Syracuse, N. Y. The New England office is located at 60 State St., Boston. Mr. Ilsley, was at one time identified with the Reed-Prentice Company, of Worcester, Mass.

WILLIAM SANGER, was recently elected treasurer of the Boston Pressed Metal Co., Union St., Worcester, Mass. Mr. Sanger, was formerly with the Clauss Shear Co., of Fremont, Ohio, as general manager.

R. W. WOODWARD, has been recently appointed metallurgist at the plant of the Whitney Manufacturing Co., Hartford, Conn.

DOUGLAS B. COOK, has been recently elected president and general manager of the Boston Pressed Metal Co., Union St., Worcester, Mass. Mr. Cook was formerly general manager and succeeds Herbert A. Pike, who recently retired from the firm.

THOMAS E. HYDE, factory manager of the National Pipe Bending Co., New Haven, Conn., has been elected president and general manager of the recently incorporated Riverside Bronze and Aluminum Co., of New Haven. Mr. Hyde will continue in his present capacity with the National company.

CARL H. PETERSON has been elected secretary-treasurer and general manager of the Maher Engineering Co., with offices at Chicago. He was formerly vice-president and general manager of the Viking Corporation, manufacturers of automatic fire protection apparatus, Hastings, Mich.

ROLAND H. BAKER has resigned his position as chief engineer for the United States Shipping Board to organize the General Construction and Repair Co., Cambridge, Mass., of which he is president and general manager.

EDGAR C. CUMMINGS, formerly of the Cummings Machine Co., Minster, Ohio, has severed all connections with that company and is now president of the Neidow-Cummings Company, Chicago, Ill.

E. H. EARNSHAW, JR., who until recently was with the Worthington Pump and Machinery Corporation, is now associated with the American Laundry Machinery Co., as salesman at the New York office.

J. E. SLIMP, formerly with the Ohio Brass Co., at Massillon, Ohio, has resigned as sales manager in the Chicago office of the E. T. Chapin Co., Seattle, Wash.

PAUL A. BILLINGS who was recently appointed representative of the Falcon Steel Co., Niles, Ohio, has announced the establishment of headquarters at 2306 Dime Bank Building, Detroit, Mich.

ALLEN BAKER, formerly with the Honeyman Hardware Co. Portland, Ore., has been appointed manager of a branch office opened in the Henry building, Portland, Ore., by John T. Rowntree, Inc., western representative of the Falcon Steel Co.

HARRY S. ALLEN, formerly sales manager of the machine tool division of the Fairbanks Company, is now associated with the D. Nast Machinery Co., of Philadelphia, Pa.

Obituary

WILLIAM S. MONKS, thirty-five years old, mechanical and refrigerating engineer, died at his home in Mt. Vernon, N. Y., on Dec. 28. He was an executive with the De La Vergne Machine Co., and a member of several engineering bodies including the New York Society of Mechanical Engineers.

WINFIELD E. HOLMES, treasurer of the Samuel M. Green Co., Springfield, Mass., died in that city on Dec. 25. He was secretary of the Engineering Society of Western Massachusetts and a member of the Engineers' Club of New York. He was rated as an authority on power plants and industrial equipment and processes, and was a consulting engineer for numerous large manufacturers.

ANTON MILL, SR., seventy-two years old, president of the A. Mill Engineering Co., died at his home in Mt. Washington, Ohio, a suburb of Cincinnati, after a prolonged illness. Mr. Mill had been in the engineering business in Cincinnati for more than twenty years. Previous to organizing the company bearing his name, Mr. Mill had an interest in the old Bickford Machine Tool Co.

Trade Catalogs

Die Heads. Eastern Machine Screw Corporation, New Haven, Conn. A one-hundred page catalog describing a comprehensive line of H & G self-opening die heads, and containing many pages of information valuable to the machinist. A feature is complete instructions on "How to Grind Chasers," and a description of the new die head for use with B & S automatics. The book is fully illustrated and indexed.

Bench Lathe. B. C. Ames Co., Waltham, Mass. Circular describing the Ames No. 3 bench lathe for precision work. Individual parts are illustrated.

Truscon Steel Sash. Truscon Steel Co., Detroit, Mich. A "Handbook of Truscon Steel Sash," 80 pages of standard dimension tables, details, specifications and illustrations of use of steel in window frames.

Drill Chucks. E. Horton & Son., Windsor Locks, Conn. A series of circulars describing several types of drilling machine chucks.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm of importers in CHILE desires to secure an agency for the sale of industrial machinery. Correspondence should be in French or Spanish. Reference No. 462.

A merchant in MEXICO desires to purchase and secure an agency for the sale of general hardware, wire products, iron pipe, sewing machines, machinery and agricultural implements. Quotations should be given f. o. b. Manzanillo. Cash to be paid. Reference No. 463.

An engineer in SWITZERLAND desires to secure an agency for the sale of steel wire and other articles in seel, iron, brass or copper; tools and electrical apparatus; construction for buildings, etc. Quotations should be given c. i. f. Basel or Zurich. Reference No. 467.

Book Reviews

Time Study and Job Analysis. By William O. Lichtner, consulting engineer in management and construction. Three hundred ninety 6 x 9-in. pages, 81 charts, tables and illustrations; blue cloth boards. Published by the Ronald Press Co., New York City. Price $6.

An able treatment of the application of time study and job analysis. These two subjects are explained in detail as to definition and use. Directions for training the personnel of the staff for time study and job analysis are given. A large part of the book is devoted to the detail of installing and maintaining the standard methods determined by job analysis. Chapters are devoted to the balancing of manufacturing and selling activities, and job standardization as a basis for labor mediation.

Headings of other chapters are: Job standardization defined; Method of procedure; Results of job standardization; Personnel requirements; Non-intensive course in training personnel; Intensive course in training personnel; Enlisting co-operation; Relation of phases in job standardization: Making the preliminary study; Taking the times; Computing and analyzing time values of elements; Determining standard time for the operation; Fatigue; Checking standard times; Deciding the rates on the operation; Summarizing the standards and instructions; Explaining the standards; Applying the standards; Perpetuating the standards; Scientific management and increased production.

Machine Drawing. By Carl L. Svensen, assistant professor of engineering drawing in Ohio State University. Two hundred nine 6 x 9-in. pages, cloth boards, 338 line drawings, tables. Published by D. Van Nostrand Co., 8 Warren St., New York City. Price $2.25.

A book intended for technical students and draftsmen, well written and arranged. The subject matter is comprehensive and is presented in the form of text and problems. Beginning with elementary principles, such as the use of the pencil, scale, pen, kinds of lines, the various views, etc., the following subjects are taken up successively: Fastenings for machinery, machine drawing, principles and practice of dimensioning, machine details, bearings, pulleys, etc., shafting and couplings, jigs, fixtures and details, gears and cams, piping drawing. The final chapter is devoted to problems and studies.

New England-Where is your Business Going? Prepared by C. H. Bunting of the staff of Walter B. Snow and published by Walter B. Snow and Staff, Boston, Mass. Fifty 5 x 8-in. pages.

This pamphlet is based on an analysis of the sales and advertising in several standard industries of the country, in which the New England states have taken a leading position. It shows the gains and losses of various parts of the country, and points out that in almost every case the rate of growth in New England has been far below that in other sections. The failure of New England manufacturers to hold their own is laid to their complacency and to their relatively small use of advertising. The analysis is an excellent piece of work and contains much valuable statistical matter.

Forthcoming Meetings

American Engineering Council: Annual meeting Jan. 5 and 6, Washington, D. C. L. W. Wallace is secretary.

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

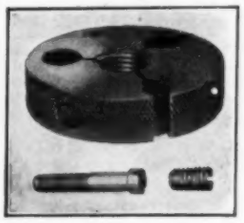
American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

Condensed-Clipping Index of Equipment

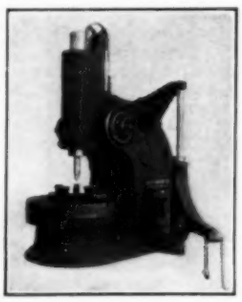
Patented Aug. 20, 1918

Gage, Templet, Thread
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," August 25, 1921.



These thread templet gages are of the usual round adjustable type, but are said to incorporate improvements in the adjustment. One full turn of the tapered adjusting screw changes the effective diameter of the gage about 0.001 in., and adjustments finer than 0.0001 in. can be made. When the locking screw is tightened, the threads of the taper screw form a dowel. The gage is made in all sizes from 1/16 to 5 in. or larger.

Boring Machine, Car-Wheel, Railroad, 52-In.
Betts Machine Co., Rochester, N. Y.
"American Machinist," September 1, 1921.

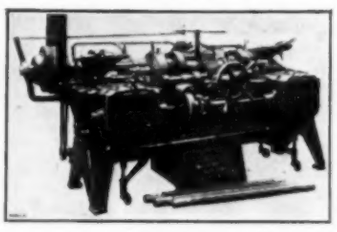


This 52-in. car-wheel boring machine is intended as a rapid production machine for both car-building and railroad repair-shop work. The boring ram has a long bearing in the frame and hand adjustment, which is facilitated by a counterweight. The machine can be equipped with a facing ram. The table is equipped with a five-jaw combination chuck. Six boring and facing feeds are provided. All control levers are within easy reach of the operator. The drive may be through either a single pulley or by direct-connected motor. The regular equipment includes a quick-acting air-operated crane for handling wheels.

Testing Machine, Hardness, Cimbination Brinell and Scleroscope
Riehle Bros. Testing Machine Co., Philadelphia, Pa.
"American Machinist," September 1, 1921.

The machine is intended for testing the hardness of chilled car-wheel treads. It is possible to employ both the Brinell and scleroscope methods on the same spot. The Shore scleroscope and Brinell weighing systems are carried by the same housing, which is bolted to a turn table so that the whole upper part of the machine can be revolved. An inclined track makes it possible to roll a wheel into place. After the scleroscope has been used, the turn table is revolved 180 deg., which brings the ball into position for the Brinell test. The rollers supporting the wheel rest on an hydraulic plunger, and a few strokes of the hand pump raise the wheel against the ball.

Lathe, Axle, Semi-Automatic
T. C. M. Manufacturing Co., Harrison, N. J.
"American Machinist," September 1, 1921.



This special semi-automatic machine is for machining automobile and truck axle shafts. The shaft is placed in the hollow spindle of the machine and is held by two scroll chucks. The machine squares the ends of the shaft to length and turns down each end to the correct diameter. The ends are then centered simultaneously. Two slides make several movements across the work, the tools being advanced the proper amount for the cut by screw adjustments. The cutting tools are either circular formed tools or solid rectangular tools. Three spindle speeds and three feeds are provided by quick-change gears. Shafts varying in length from 36 to 48 in., and in diameter from 1⅞ to 2¾ in. can be handled.

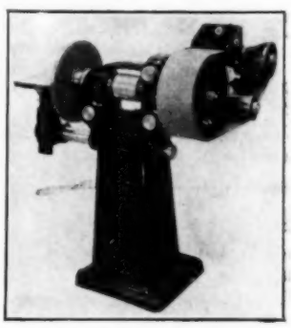
Gages, Plug, Reversible
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," August 25, 1921.

The cylindrical plugs are machine lapped by a modification of the Hoke process, and it is said that they are perfectly round and of uniform size from end to end. The handle is of hexagon stock. Three prongs on the handle, of 90-deg. included angle, engage three grooves of 75-deg. included angle in the gage end. By means of a single screw through the gage, the wedge-like prongs are forced into the grooves. The rigidity is said to be practically that of a solid gage. The range of available sizes is fom ¼ to 2 in.

Broaching Machine, High-Speed, Heavy-Duty, No. 4
Velco Manufacturing Co., Inc., Greenfield, Mass.
"American Machinist," September 1, 1921.

The machine is said to be very rapid in operation, making the cutting stroke at a speed of 15, and the return at 55 ft. per min. The broach holder is attached to a solid steel head, supported by bronze gibbed bearings sliding on steel ways. The broach is attached to the rack so that the pull comes directly on the rack pitch line. All vertical adjustments are made at the face plate. There are no friction clutches employed in the drive. Centralized control is provided, a single lever regulating every motion of the machine. The machine has only one speed, and 10 to 15 hp. are required.

Grinding and Polishing Machine, Combination, Utility, Type-R
Production Machine Co., Greenfield, Mass.
"American Machinist," September 1, 1921.



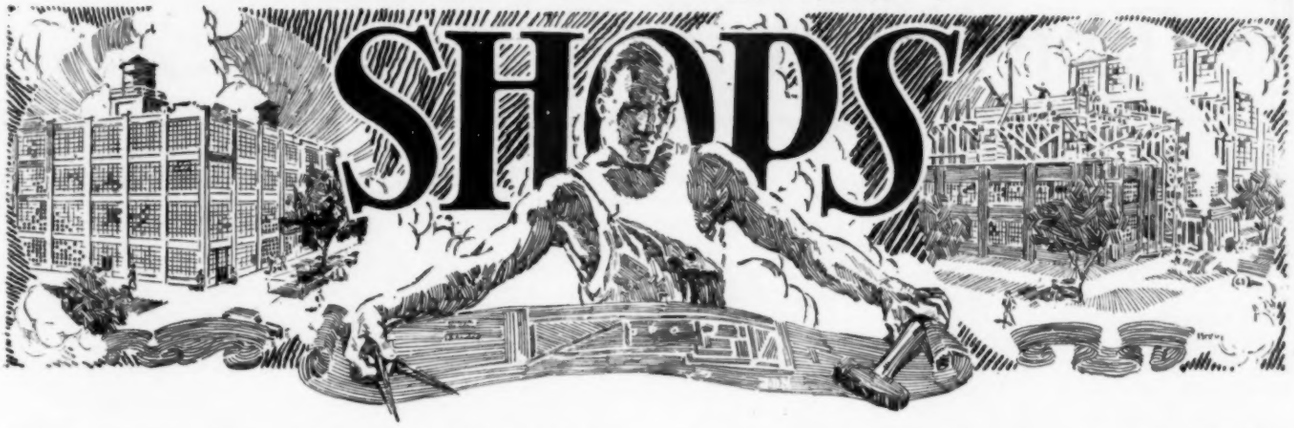
The base and head are one casting. The spindle runs in Timken roller bearings. Adjustment for wear is provided by a threaded sleeve and nut. One end of the spindle is furnished with a double-faced disk and the other with a leather-cushioned wheel, over which runs a 6-in. endless abrasive belt. A quick adjustment for tracking the belt and an idler for keeping it tight are provided. A table for surfacing work on the belt is furnished. The table for disk grinding has both vertical and circular adjustments, and is provided with a rocking seat to accommodate beveled work.

Straightening and Calibrating Machine, Gun Barrel
Fairbanks Company, Broome and Lafayette Sts., New York.
"American Machinist," September 1, 1921.

It is said that this machine will straighten rifled barrels as easily as smooth bores and that barrels can be straightened to within 0.002 in. for their entire lengths. The gun barrel is held in a vertical position in the machine, where it is rotated about its axis by the operator, thus bringing every part of the bore to pass by a fixed point or "feeler" within the bore. Whenever the feeler comes in contact with the bore it completes an electrical circuit which registers on a voltmeter. When the peak of the crook has been determined, two jaws are brought into contact with the barrel and the necessary pressure is applied to straighten it.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Pa., New Castle—The Bd. Educ., B. C. Graham, Supt. Schools—shop equipment for the manual training dept. of new high school now under construction.

Tenn., Ducktown—The Ocoee Copper Co., L. W. Hope, Genl. Supt.—small machine tools, pneumatic rock drills, mine hoist, screens, conveyor belts, motors and rock crushers.

Va., Keysville—J. L. Pearson—one 16 in. x 6, 8 or 10 ft. engine lathe with all attachments and screw cutting, also a 16 or 18 in. wood lathe with shears complete (new or used).

Va., Norfolk—The Sea Board Air Line Ry. Co., Boyster Bldg.—two 30 in. engine lathes, one 20 in. engine lathe, one portable crank for truing machine, one 36 in. draw cut shaper, one 3,000 lb. steam hammer, one 42 in. car wheel borer, one 48 in.-400 ton double end wheel press, one 2 in. x 26 in. turret lathe, one turret lathe arranged for bar stock, one 36 in. vertical turret lathe and one 28-48 in. Gap lathe.

W. Va., Bluefield—The Bond Motor Co.—complete machinery and equipment for automobile repair shop.

Ill., Beardstown—The Bd. Educ., H. E. Russell, Supt. of Schools—manual training and domestic science equipment.

Ill., Chicago—F. H. Noble & Co., 555 West 59th St.—one No. O. B. & S. automatic screw machine.

O., Cincinnati—The Eastern Mchy. Co., 408 East Pearl St., R. Smith, Purch. Agt.—one 16 in. swing lathe, 10 ft. between centers; one No. 2 Universal milling machine; one punch and shear 12 in. throat for ⅞ x ⅞ in. bars.

O., Cleveland—The Torbensen Axel Co., 115 East 152nd St.—multiple spindle drill head.

O., Portsmouth — The Wolford Machine Co., capitalized at $10,000, G. Wolford, Genl. Mgr.—machine tools.

Wis., Milwaukee—The Arpe Motor Co., 3811 Fond du Lac Ave. (garage and repair shop), E. Arpe, Purch. Agt.—lathe, arbor press, emery wheel and motors.

Wis., Milwaukee — Englert Bros., 1524 Vliet St., M. Englert, Purch. Agt.—power operated metal working machinery including square shear, brake, folders, beaders, etc.

Wis., Milwaukee—The Hercules Rack Co., 1566 26th St., F. J. Trapp, Purch. Agt.—four punch preses to punch ¼ x 5/16 holes through ¼ stock.

Wis., Milwaukee—G. W. Neeb, 1104 Burleigh St.—speed lathe and drill press suitable for auto repair work.

Wis., Neenah—The Tri City Nash Co., 110 North Church St.—equipment for auto repair shop.

Wis., Sheboygan—The city, c/o C. Boley, City Engr. — machine tool and manual training equipment.

Wis., Viroqua—The Allen Machine Co., L. Allen, Purch. Agt.—medium size lathe, grinder and drill press.

Wis., West Allis — The Liberty Garage Co., 4908 National Ave. W. Breitman, Purch. Agt.—lathe suitable for repair work, drill press, grinders and motors.

Wis., West Allis—The Reliance Battery & Repair Co., 460 51st Ave., J. Pettigrew, Purch. Agt.—small lathe, emery wheel and drill press.

Mo., St. Louis—F. E. Palmer Supply Co., 2091 Ry. Exch. Bldg., manufacturer of railway, mine and mill supplies—one Hanna riveter 10 ft. reach to drive 1 in. steam tight rivets.

Neb., Lincoln—The Bd. Educ. is not in the market for equipment for shops. This corrects report in Dec. 15 issue.

Pa., Ellwood City — The Ellwood City Forge Co., 10th St.—one 15 ton crane with 60 ft. span.

Pa., Jeanette — The Elliot Co.—50 ton crane with 10 ton auxiliary.

Ala., Florence—The Muscle Shoals Rock Asphalt Co. 103 Court St., A. J. Bright, Ch. Engr.—four jaw crushers, 400 ton capacity, suitable for crushing rock asphalt quartz; four conveyors (from crusher to pulverizer); four steel rollers 48 in. diameter, about 30 in. long for pulverizing asphalt; several air compressors, jack hammer drills, also ¼ ton revolving shovel dipper, prefer caterpillar (used dipper if in good condition).

Va., Richmond—Jerry Bros. Belting Co., 1823 East Main St.—14 to 20 in. lever leather belting presses, and a feed roll splitting machine (new or used).

Ill., Chicago—The Central Malleable Castings Co., 549 West Washington St.—air compressor.

Ill., Chicago—The Santa Fe R.R., 80 East Jackson Blvd.—one planer, 48 x 48 in. x 12 ft., two heads on cross rail and one side head, belt and motor driven.

Ill., Chicago—The Wahl Co., 1800 Roscoe St., E. R. Paffenrath, Purch. Agt.—hydraulic press and pump, pressure of which is to be 1,000 ton or more (used).

Ind., Vincennes—Vincennes Bridge Co.—one motor driven, 220 volt, rotary planer to mill ends of top chords, etc.

Mich., Detroit — The Aetna Portland Cement Co., 412 Union Trust Bldg.—equipment, including crushers, grinding mills and conveyors, for proposed cement plant along the Saginaw River at Bay City.

Mich., Detroit—The Natl. Portland Cement Co., 519 Book Bldg.—equipment for its proposed plant at Mt. Pleasant.

O., Columbus—The Columbus Milling Co., 304 West Mound St., organized with $150,000 capital stock, A. C. Smith, Genl. Mgr.—flour making machinery for plant which it has recently taken over.

Wis., Beaver Dam—The Bartelt Bros. Co.—several ice machines for proposed ice cream plant on South Division St.

Wis., Cudahy—Cudahy Bros.—woodworking machinery, planers, etc.

Wis., Madison—B. M. Backus, 102 State St.—paper cutting machine to cut ream 17 x 22.

Wis., Milwaukee — F. Matt, 1137 Grant Blvd.—Universal woodworker and band saw.

Wis., Milwaukee—H. B. Stanz Co., 312 Bway. (cheese manufacturer) — one belt driven steam mangler.

Wis., Oconomowoc—E. O. E. Otto Inc.—band saw about 30 in., rip saw, jointer with 12 in. table, mitre machine, hollow chisel mortiser and electric motors.

Wis., Oconto Falls—The Falls Mfg. Co.—paper machinery for proposed mill.

Wis., Waunakee — The Waunakee Milk Products Co., F. Whiting, Mgr.—dairy machinery, belt driven.

Kan., Topeka—The Seymour Packing Co., 200-202 North Kansas St.—ice machinery for proposed cold storage plant.

Cal., San Francisco—Shell Co. of California, 343 Sansom St. — equipment for proposed distributing station at Chico.

Ont., Chatham—The Union Natural Gas Co.—piping, tools, and drilling equipment for drilling wells.

Ont., Collingwood—J. Grey, Maple St.—equipment for proposed steel spring and steel specialty factory.

Ont., London—W. Ward & Sons, 19 King St.—machinery cutters and special equipment for the manufacture of cigars, to replace that which was destroyed by fire. Estimated loss, $25,000.

Ont., Ottawa—The Hamilton Tar & Ammonia Co., Lees Ave., W. M. Currie, Pres.—tar stills, tanks and all machinery and equipment for proposed tar and ammonia factory.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford—The Charter Oak Machine Co., 438 Asylum St., has awarded the contract for the construction of a 1 story, 60 x 100 ft. factory for the manufacture of auto accessories. Estimated cost, $150,000.

Mass., Boston—M. Rudnick, 40 Court St., will build a 2 story, 100 x 120 ft. sales and service station at 872-8 Commonwealth Ave. Estimated cost, $120,000.

MIDDLE ATLANTIC STATES

N. J., Fernwood—(Trenton P. O.)—The State Hy. Dept., Trenton, will soon award the contract for the construction of 1 story 106 x 404 ft. auto service station here. Estimated cos, $94,300. C. A. Mead, 790 Broad St., Newark, Engr. Noted Dec. 15.

N. J., Jersey City — The Erie R.R., 50 Church St., New York City, has awarded the contract for the construction of a 1 story round house, machine shop and boiler plant, on Pavonia Ave. Estimated cost, $75,000.

N. J., Pleasantville — The Penn Motors Corp., c/o H. W. Sofield, 1719 North Broad St., Phila., Pa., will soon award the contract for the construction of a 1 story, 50 x 300 ft. factory and power plant here. Estimated cost, $125,000. C. Donehower, Pleasantville, Engr.

N. Y., Hornell—The Dairymen's League plans to construct a milk condensing plant here. Estimated cost, $200,000.

Pa., Phila.—The Allen Iron & Steel Co., 3rd and Venango Sts., has awarded the contract for the construction of a 2 story, 40 x 100 ft. addition to its mill. Estimated cost, $25,000.

Pa., Phila.—The Phila. Steam Heating & Eng. Co., Juniper and Cherry Sts., is having plans prepared for the construction of a 2 story, 57 x 120 ft. shop and office

The Weekly Price Guide

This Week's Market

Pig iron, Eastern Pa. No. 2X, is quoted in Philadelphia at $20.76 as against $23.26 per gross ton, one week ago. Steel prices remain unchanged at the Pittsburgh mills with $1.50 on structurals in 100 ton lots and $1.60 per 100 lb. on smaller tonnages.

The New York warehouses quote tin at 33¼c. as against 34c. and spelter at 5¼c. as compared with last week's price of 5⅝c. per lb.

Cleveland quotes solder at 23¼c. as against 21¼c. and decreases ranging from ⅛c. to ¾c. per lb. in tin plates (base size).

Linseed-oil declines 1c. per gal. in Cleveland, prices firm in New York and Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	20.76
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	¾ to 1½	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	69	57½	1 to 1½	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.53	3.11	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.55	3.50	3.55
Cold finished flats, squares	4.05	4.00	4.05
Structural shapes (base)	2.78	2.61	2.88
Soft steel bars (base)	2.68	2.51	2.78
Soft steel bar shapes (base)	2.68	2.51	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.61	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
3/32	8.50		12@13
⅛	7.15		11@12
3/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			14.37½
Tin, 5-ton lots, New York			33.50
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 5.10; New York			5.50
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper bars (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb. lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	21.00	23.50	19.25
Babbitt metal (best grade)	24.62½	43.75	36.00
Babbitt metal (commercial)	9.87½	13.50	9.00

—Shop Materials and Supplies

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.25	11.50	11.00
Copper, heavy, and wire	11.00	11.00	10.00
Copper, light, and bottoms	9.50	9.00	8.75
Lead, heavy	4.00	3.75	3.50
Lead, tea	3.00	2.75	3.00
Brass, heavy	7.00	6.50	8.50
Brass, light	5.00	4.50	5.00
No. 1 yellow brass turnings	5.75	5.50	5.75
Zinc	3.00	2.50	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	22.50	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	12.00	14.50
IC,	112 sheets	12.80	12.30	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	2.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.76	.74
White lead, dry or in oil	100 lb. kegs.	New York,	12.25
Red lead, dry	100 lb. kegs.	New York,	12.25
Red lead, in oil	100 lb. kegs.	New York,	13.75
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton	$2.90@3.00	
Coke, prompt foundry, Connellsville	per ton	3.75@4.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1¼ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	.....	-65-5%
Lag screws, coach screws	—50–10%	.....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50–5%
Bolt ends, with hot pressed nuts	—50%	.....	—55%
Tap bolts, hex. heads	—20%	.....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ½ in., per 100 lb. Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅜ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	3.50	3.43
Cone heads, ditto (net)	3.60	3.60	3.53
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅞ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$4.03 base
Copper rivets	—60–5%	—40-10%	—50-10%
Copper burs	—40%	—15%	—10%
Lard oil, pure, (50 gal. bbl.) per gal.	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50–5%	50–5%	60–10%
Medium grade	45%	40–10–2½%	50%
Heavy grade	40%	40%	40–5%
Rubber and duck:			
First grade	50–10%	50–10%	.....
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	List $9.00 less 20-10-5%	50–10–5%-20-10%	
Emery paper	List 11.00 less 20%	$11.00 net -20%	
Emery cloth	List 32.75 less 10%	32.75 net -10%	
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll, $4.50 net		.....	list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	-10%
Cloth	List $3.55 less 10%	.....	-10%

building at 3316-20 Lancaster Ave. Estimated cost, $60,000. Private plans.

Pa., Phila.—C. Offenhauser, Wensley and Allen Sts., has awarded the contract for the construction of a 1 story addition to his machine shop. Estimated cost, $5,000.

SOUTHERN STATES

W. Va., Wheeling—The Wheeling Mold Fdry. Co., Peninsular St., has awarded the contract for the construction of a 1 story, 60 x 287 ft. roll shop. Estimated cost, $50,000.

MIDDLE WEST STATES

Ill., Chicago—R. H. Oliver, Archt., 115 South Dearborn St., is receiving bids for the construction of a 2 story, 42 x 71 ft. factory at 7512 Greenwood Ave. for the Dental Products Co., 623 South Wabash Ave. Estimated cost, $30,000.

Ill., Chicago — H. Salvat, 5322 Harper Ave., has awarded the contract for the construction of a 1 story, 100 x 180 ft. garage at 5018 Cottage Grove Ave. Estimated cost, $50,000.

Ill., Chicago—The Western Fixtures Mfg. Co., 3039 Elston Ave., manufacturer of store fixtures, is receiving bids for the construction of a 1 story, 80 x 119 ft. addition to its factory. Estimated cost, $40,000.

Ill., Rockford—The Allen Ice Cream Co., 327 South Winnebago St., has awarded the contract for the construction of a 2 story garage and warehouse. Estimated cost, $26,000. Noted Dec. 22.

Ind., Indianapolis — The Alena Steam Products Co., 208 Hume-Mansur Bldg., is having plans prepared for the construction of a 1 story, 60 x 60 ft. tractor and truck factory on Denny Ave. Estimated cost, $25,000. F. Hamilton, 208 Hume-Mansur Bldg., Engr.

Ind., Indianapolis—The Citizens Gas Co., South Pennsylvania and Maryland Sts., plans to construct a coke screening plant on Prospect St. Estimated cost, $40,000. Private plans.

Ind., Indianapolis — The Interstate Car Co., Sherman Drive and Massachusetts Ave., plans to build an iron casting foundry. Estimated cost, $25,000. Architect not selected.

Ind., Indianapolis — The Wayne Oil & Tank Co., 58 West New York Ave., plans to construct an addition to its factory, for the manufacture of pumps, tanks and water softeners. Estimated cost, $150,000. Private plans.

Mich., Grand Rapids—The Buick Sales Co. is having plans prepared for the construction of a 3 story, 70 x 160 ft. garage and sales station. Estimated cost, $75,000. Osgood & Osgood, Grand Rapids, Archts. W. H. Adams, Campau Bldg., Detroit, Engr.

Mich., St. Joseph—The Auto Specialty Mfg. Co., is having plans prepared for the construction of a 1 story, 80 x 325 ft. and a 1 story 80 x 162 ft. addition to its factory. Estimated cost, $100,000. Davidson & Weiss, 53 West Jackson Blvd., Chicago, Ill., Archts.

O., Cleveland — The Specialty Mfg. Co., 11414 Madison Ave., plans to construct a 2 story factory for the manufacture of wire brushes. Estimated cost, $50,00. Architect not selected.

O., Columbus—The Carroll Chain Co. has awarded the contract for the construction of a 1 story, 50 x 160 ft. chain factory on 7th and Hosack Sts. Estimated cost, $50,000.

O., Minerva—The Lewis Electric Mfg. Co. is having plans prepared for the construction of a 2 story, 60 x 400 ft. factory. Estimated cost, $75,000. Watson Eng. Co., 3614 Prospect Ave., Cleveland, Archts.

Wis., Fond-du-Lac—The East Wisconsin Electric Co., 15 North Main St., has awarded the contract for the construction of a 2 story, 50 x 90 ft. gas plant and foundry. Estimated cost, $45,000. M. H. Frank, Mgr.

Wis., Milwaukee—The Alliance Investment Co., 115 Wisconsin St., has awarded the contract for the construction of a 1 story, 60 x 120 ft. garage on Bway. Estimated cost, $40,000. Noted Dec. 8.

Wis., Neenah—The Tri City Nash Co., 110 North Church St., has awarded the contract for the construction of a 55 x 150 ft. garage on Commercial St. Estimated cost, $60,000. Noted Dec. 8.

WEST OF THE MISSISSIPPI

Mo., St. Louis — C. Remabecker, 4263 Juniata Ave., has awarded the contract for the construction of a 1 story, 120 x 160 ft. garage on Chippewa and Nebraska Sts. Estimated cost, $50,000. Noted Dec. 15.

WESTERN STATES

Cal., Burbank—C. F. Braun Co., 604 Mission St., San Francisco, manufacturer of factory equipment, auxiliary machinery, water heaters, water softeners, etc., is preparing plans for the construction of foundries, machine shops, pattern shop, etc., here. Estimated cost $400,000.

Cal., Chico — (Hamilton City P. O.) — Shell Co. of California, 343 Sansom St., San Francisco, has awarded the contract for the construction of a distributing station, to include garage, offices, wagon sheds, etc., here. Estimated cost, $30,000.

Cal., Los Angeles—The California Telephone Co. has awarded the contract for the construction of a 1 story, 250 x 250 ft. garage on 9th and San Pedro Sts. Estimated cost, $115,450.

Cal., San Francisco — The Bothin Real Estate Co., Atlas Bldg., has awarded the contract for the construction of a 2 story electric supply shop on Felsom St. east of 2nd St. Estimated cost, $31,000.

Cal., San Francisco—R. W. Kern, 1329 Sacramento St., is having plans prepared for a 1 story garage on the west side of Jones St., near O'Farrell St. Estimated cost, $40,000. O'Brien Bros., Inc., 240 Montgomery St., Archts.

CANADA

Ont., Collingwood—J. Grey, Maple St. has had plans prepared for the construction of a factory, for the manufacture of steel springs and steel specialties. Estimated cost, $15,000.

General Manufacturing

MIDDLE ATLANTIC STATES

N. J., Bloomfield—The Amer. Book Co., 100 Washington Sq. East, New York, plans to build a 222 x 502 x 616 ft. publishing plant on Bloomfield Ave., here. Architect not selected.

N. Y., New York—F. M. Schildwachter, c/o Koch & Wagner, Archts. and Engrs., 32 Court St., Brooklyn, is having plans prepared for the construction of an ice plant on Webster Ave and 174th St. Estimated cost, $750,000.

N. Y., New York—The U-Need Ice Co., 2950 Amsterdam Ave., will soon receive bids for the construction of an ice plant on Inwood Ave. Estimated cost, $250,000. Koch & Wagner, 32 Court St., Brooklyn, Archts. and Engrs.

Pa., Erie—The Erie Brewing Co. has awarded the contract for the construction of a 1 story, 38 x 75 ft. ice plant (50 ton capacity) and a storage plant (4,400 ton capacity),

Pa., Harrisburg—The School Dist., 121-23 Chestnut St., will receive bids until Jan. 6 for the construction of a 2 story, 80 x 200 ft. school on 3rd and Division Sts. Bids now for two of three units of new senior high school to include superstructure and wing shop. Bids will be received later for boiler rooms, etc. Estimated cost $300,000.

Pa., Phila.—Grubman Bros., 114 Arch St., manufacturers of woolen goods, have awarded the contract for the construction of a 1 story, 76 x 205 ft. factory on 2nd St. and Erie Ave. Estimated cost, $40,000.

Pa., Phila. — The Hulton Dyeing Co., Wheatsheaf Lane and Carrol St., has awarded the contract for the construction of a 2 story, 59 x 124 ft. dye factory. Estimated cost, $30,000.

Pa., Phila.—J. Turner & Co., A and Allegheny Aves., has awarded the contract for the construction af a 2 story, 68 x 113 ft. knitting factory on Ashmead and Wakefield Aves. Estimated cost, $20,000.

SOUTHERN STATES

Ky., Louisville — The Natl. Candy Co., Federal Reserve Bank Bldg., St. Louis, Mo., has awarded the contract for the construction of a 5 story candy factory (known as the Frank A. Menne Factory), 1456 Bway., here. Estimated cost, $600,000.

La., Bogalusa—The Bogalusa Paper Co., subsidiary of Great Southern Lumber Co., Whitney Bldg., New Orleans, plans to build an addition to its paper mill here. Estimated cost, $1,000,000. W. H. Sullivan, Genl. Mgr.

MIDDLE WEST STATES

Ill., Chicago—The Dubow Glove Co., 1911 Milwaukee Ave., has awarded the contract for the construction of a 3 story, 35 x 45 ft. addition to its factory. Estimated cost, $40,000

Ill., Kankakee—The Paramount Knitting Co., 337 West Madison St., Chicago, has awarded the contract for the construction of a 2 story, 50 x 80 ft. addition to its factory, here. Estimated cost, $40,000.

Ill., Rockford—The Hess & Hopkins Leather Co., c/o F. L. Morgan, Secy., is having plans prepared for the construction of a 1-story, 60 x 115 ft. tannery. Estimated cost, $40,000. Private plans.

Ind., Frankfort—Ingram-Richardson Mfg. Co., Walnut St., manufacturer of enamel specialties, plans to construct a 1 story, 60 x 160 ft. factory on Walnut St. Estimated cost $25,000. Architect not selected.

Ind., Franklin—D. M. Hoagland & Co., Scottsburg, has awarded the contract for the construction of a 3 story, 130 x 134 ft. canning factory here. Estimated cost, $75,000. Noted Dec. 15.

Ind., Indianapolis—M. Schussler, 407 East Washington St., plans to construct a 1 story packing plant on East Washington St. Estimated cost, $25,000. Architect not selected.

Ind., Lebanon—N. N. Smith Co., 407 Main St., Frankfort, is having plans prepared for the construction of a 2 story, 38 x 110 ft. cigar factory and office building here. Estimated cost, $25,000. Private plans.

Mich., Bay City—The Aetna Portland Cement Co., 412 Union Trust Bldg., Detroit, is having plans prepared for the construction of a complete plant to include 3 kilns, etc., along the Saginaw River, here. Estimated cost, $1,000,000. Private plans.

Mich., Mt. Pleasant—The Natl. Portland Cement Co., 519 Book Bldg., Detroit, plans to build a plant here, for the manufacture of portland cement using marl as raw material. Estimated cost, $500,000. H. C. Shields, Genl. Mgr.

O., Dayton—The Terminal Cold Storage & Ice Co., c/o B. & C. Baking Co., 233 Clinton St., is having plans prepared for the construction of an 8 story, 135 x 150 ft. refrigerating and cold storage plant on Eaker and Ludlow Sts. Estimated cost, $500,000. H. J. Brenner, Pres. G. B. Bright Co., 103 Marquette Bldg., Detroit, Archts.

Wis., Beaver Dam—Bartelt Bros. Co. has purchased a site on South Division St. and plans to build a 1 and 2 story, 40 x 140 ft. ice cream plant. Estimated cost, $100,000. Architect not selected.

Wis., Cudahy — Cudahy Bros. have awarded the contract for the construction of a 1 story, 80 x 190 ft. box factory. Estimated cost, $60,000. Noted Dec. 15.

Wis., Milwaukee — The Harsh-Chapline Shoe Co., 694 Hanover St., will soon award the contract for the construction of a 2 story, 32 x 110 ft. sole cutting factory on Maple St. Estimated cost, $25,000. H. J. Esser, 82 Wisconsin St., Archt. and Engr.

Wis., Oconto Falls—The Falls Mfg. Co., is having plans prepared for the construction of a 1 story, 60 x 200 ft. paper mill. Estimated cost, $150,000. Private plans.

Wis., Racine—The E. L. M. Tire Co., Deane Blvd., is receiving bids for the construction of a 2 story, 80 x 132 ft. addition to its tire factory. Estimated cost, $50,000. Private plans. Noted Dec. 8.

WEST OF THE MISSISSIPPI

Kan., Topeka—The Seymour Packing Co., 200-202 North Kansas St., has awarded the contract for the construction of a 3 story, 50 x 150 ft. cold storage plant. Estimated cost, $150,000.

Kan., Wichita—The Wichita Ice & Storage Co., 213 South Rock Island Ave., has awarded the contract for the construction of a 5 story, 75 x 90 ft. ice plant. Estimated cost, $200,000. Noted Nov. 3.

Mo., St. Clair—The International Shoe Co., 15th and Washington Sts., St. Louis, is having plans prepared for the construction of a 3 story shoe factory. Estimated cost, $75,000. H. Reinhardt, c/o owner. Archt.

Mo., St. Louis—J. H. Belz Provision Co., 2035 Gravois Ave., has awarded the contract for the construction of a 4 story, 36 x 46 ft. cooler building at 3601 South Bway Estimated cost, $40,000. Noted Dec. 22.

WESTERN STATES

Cal., Fresno—The W. P. Fuller Paint Co. plans to construct a 145 x 244 ft. paint factory. Estimated cost, $100,000. E. Mathewson, Cory Bldg., Archt.

CANADA

Ont., Toronto—A. E. Rea, 709 Continental Life Bldg., is having sketches made for the construction of a wool washing and combing plant on Bathurst St. Estimated cost, $200,000. B. H. Prack, 50 Bay St., Archt.